FIFTH FIVE-YEAR REVIEW REPORT FOR AVTEX FIBERS, INC. SUPERFUND SITE WARREN COUNTY, VIRGINIA

MARCH 2018

Prepared by

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CZA	Capture Zone Analysis
EDA	Economic Development Authority
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FAB	Fly Ash Basin
FMC	FMC Corporation
FYR	Five-Year Review
GLTP	Groundwater and Leachate Treatment Plant
GV	Gas Vent
GWMP	Groundwater Management Plan
HQ	Hazard Quotient
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg/L	Micrograms Per Liter
mg/kg	Milligrams Per Kilogram
mg/L	Milligrams Per Liter
MSL	Mean Sea Level
NCP	National Contingency Plan
NLF	New Landfill
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PB	Polishing Basin
PCB	Polychlorinated Biphenyl
PPM	Parts Per Million
PPA	Prospective Purchaser Agreement
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RI/FS	Remedial Investigation and Feasibility Study
RSL	Regional Screening Level
ROD	Record of Decision
SB	Sulfate Basin
SPLP	Synthetic Precipitation Leaching Procedure
RPM	Remedial Project Manager
SLERA	Screening-Level Ecological Risk Assessment
SVOC	Semi-Volatile Organic Compound
TCRA	Time-Critical Removal Action
TSCA	Toxic Substances and Control Act

TSDF	Toxic Substance Disposal Facility
UECA	Uniform Environmental Covenant Act
UU/UE	Unlimited Use and Unrestricted Exposure
VISL	Vapor Intrusion Screening Level
VA DEQ	Virginia Department of Environmental Quality
VB	Viscose Basin
VOC	Volatile Organic Compound
VSWMR	Virginia Solid Waste Management Regulations
WWTP	Wastewater Treatment Plant

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR Reports such as this one. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the Fifth FYR for the Avtex Fibers, Inc. Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of 10 operable units (OUs) (Table 1). EPA selected remedies in decision documents for OUs 1, 2, 3, 4, 5, 7, 8 and 10. With the exception of OU1, those OUs will be addressed in this FYR.[1] EPA established OU6 and OU9 for administrative purposes.

Table 1: Site OUs

OU1	Groundwater contamination caused by leachate leaking from Viscose Basins (VBs) 9, 10 and 11; EPA later suspended OU1 remediation and addressed the cleanup under OU7
OU2	Polychlorinated biphenyl (PCB)-impacted soil above 10 milligrams per kilogram (mg/kg)
OU3	Unstable acid reclaim buildings
OU4	Site security
OU5	Drums of hazardous substances
OU6	Investigation of on-site buildings
OU7	Groundwater, surface water and VBs 9, 10 and 11
OU8	Site areas previously known as Areas B and C
OU9	Ecological risk investigation and risk assessment
OU10	VBs 1 through 8, and the New Landfill (NLF), Plant Area Soils and the wastewater treatment plant (WWTP)

EPA Remedial Project Manager (RPM) Jeff Thomas led the FYR. Participants included EPA Chief of the Delaware, Virginia, West Virginia Remedial Branch Charlie Root, Sid Curran with EPA oversight contractor Gannett-Fleming, and Virginia Department of Environmental Quality (VA DEQ) Project Manager Michelle Payne. Skeo provided contractor support to EPA for this FYR. FMC Corporation (FMC), the potentially responsible party (PRP), was notified of the initiation of the FYR. The review began on 5/8/2017.

Site Background

The 440-acre Site is located in Front Royal, Warren County, Virginia (Figure D-1). Between 1940 and 1989, different companies, including Avtex Fibers-Front Royal, Inc. (Avtex), manufactured rayon, polyester and polypropylene fibers for commercial, defense and space industries. Plant operations generated three major waste types:

- Metal-bearing sludge generated when waste acid from the production process was treated with lime in the wastewater treatment plant (WWTP). Operators disposed of this sludge in six sulfate basins (SBs).

[1] Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed cleanup of groundwater contaminated by VBs 9-11 under OU7.

- Fly ash generated from the combustion of coal in the on-site power plant. Operators disposed of fly ash in four impoundments and one stockpile.
- Waste viscose that was primarily an off-specification product from the production process. Operators disposed of waste viscose in 11 on-site viscose basins (VBs).

Plant operators disposed of other solid wastes in an on-site solid waste landfill permitted by the Commonwealth of Virginia. Facility operations and waste disposal practices contaminated soil, sediment, surface water and groundwater with hazardous constituents, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals and carbon disulfide. In 1963, American Viscose sold the plant and property to FMC. In 1976, FMC sold the plant and property to Avtex Fibers-Front Royal, Inc. (Avtex). Following Avtex's bankruptcy in 1990, responsibility for cleanup was referred back to FMC. FMC is the Site's sole PRP.

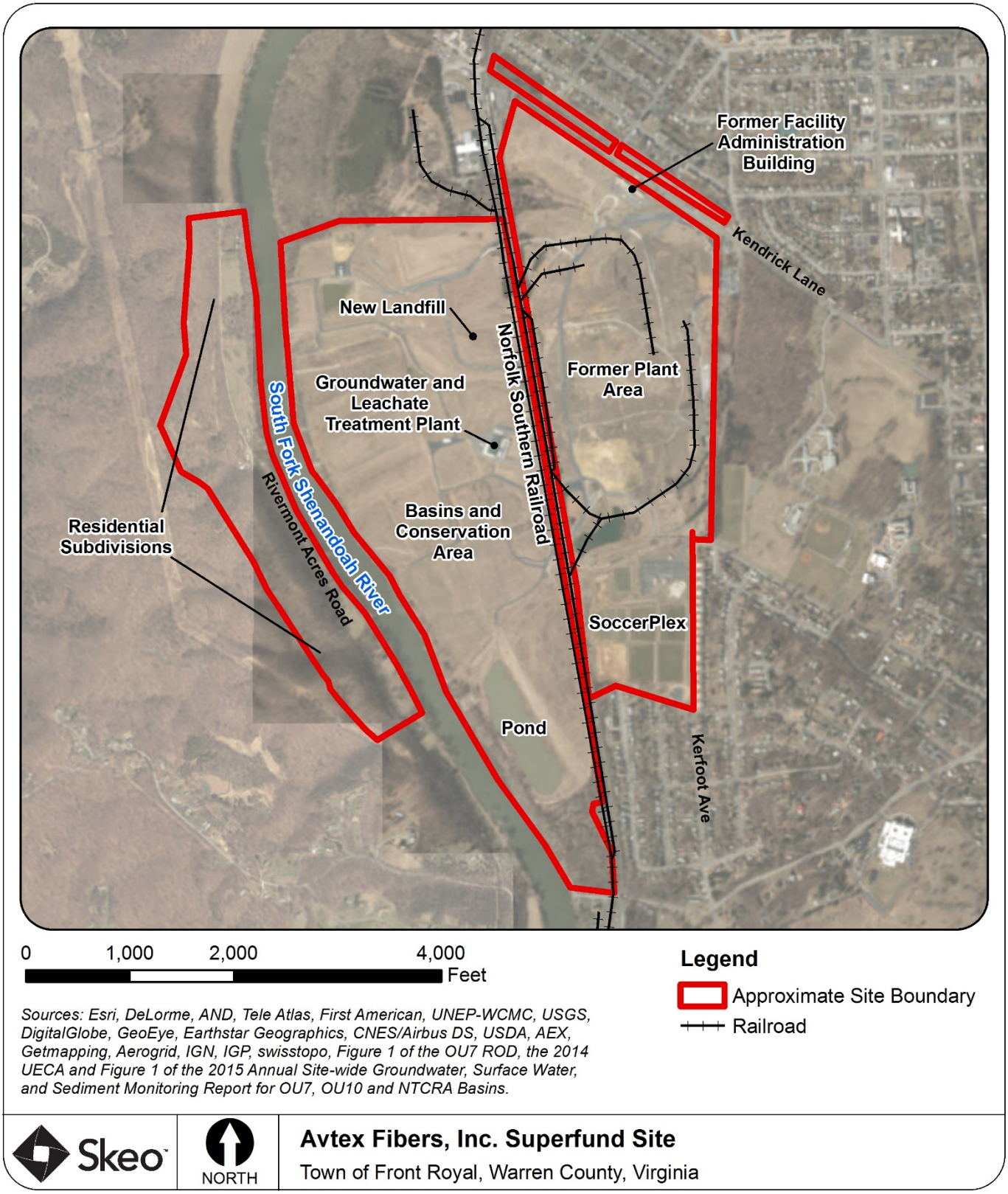
The Norfolk Southern Railroad bisects the Site from north to south and divides it into two areas. The former plant production area (plant area) occupies about 200 acres east of the railroad tracks; the Former Waste Disposal Areas occupy about 240 acres west of the railroad tracks (Figure 1). Current features of the plant area include offices within the former facility administration building, open fields and parking lots. A recreation area referred to as the Skyline SoccerPlex (SoccerPlex) occupies the far southeast part of the Site. The area west of the railroad tracks has been designated as a conservation area. It includes 23 capped or covered basins and fill areas, paved and gravel roads, a pond, remedial features and equipment, and a groundwater and leachate treatment plant (GLTP) (Figures 1 and 2). FMC's cleanup efforts on the Site's multiple capped or covered areas have resulted in the return of native vegetation and wildlife to the area. A groundwater plume from the conservation area/former waste disposal areas extends southwest under the South Fork Shenandoah River and beneath properties on the west bank of the river. Properties overlying the contaminated groundwater west of the river are considered part of the Site (Figures 1 and 3). Avtex acquired and demolished most of the properties where the contamination was discovered.

Redevelopment of the Site has been a top priority since the beginning of cleanup efforts. The Town of Front Royal and the Front Royal Economic Development Authority (EDA) worked together to develop a redevelopment plan for the Site, which has facilitated the beneficial reuse of parts of the Site. In partnership with the EDA, the U.S. Soccer Foundation, FMC and Warren County; the SoccerPlex was built on a portion of the Site in 2006. It includes a skate park, soccer fields, walking trails, a covered pavilion, restrooms and associated parking areas. The Town of Front Royal owns 5 acres of the plant area north of Kendrick Lane, which is being developed as a new police station. In December of 2017, the Town of Front Royal broke ground on the police station project. The EDA is also working to develop the former Plant Area into a commercial/light industrial area, referred to as the Royal Phoenix development. In 2014, EPA and EDA, along with other site property owners, FMC, a nonprofit organization named The Clean Water Project, Inc. (Clean Water Project), and VA DEQ, worked together to create environmental covenants that address area-specific activity and use restrictions at the Site, as well as the adjacent property to the north/northwest. The new covenants' varied restrictions and permissions for use across the Site, including light industrial/commercial uses on the plant side and support future redevelopment efforts and reuse of site properties.

Groundwater was the primary source of potable water for areas west of the South Fork Shenandoah River. FMC provides water to three private property owners on the west side of the river by filling cisterns. The Town of Front Royal provides potable water to areas east of the river via a public water supply system. There are two hydrogeologic units at the Site – the overburden unit and the shale bedrock unit. Groundwater is present in both units, although only the bedrock unit is used regionally for water supply. Lateral groundwater flow through the overburden materials is generally west toward the river, where it discharges. Groundwater within the bedrock zone flows toward the southwest. At depth, groundwater passes under the river. The primary surface water feature at the Site is the South Fork Shenandoah River. Surface water from the Site generally drains west toward the river. The South Fork Shenandoah River flows northeast to its confluence with the North Fork. Next to the Site, the river is used for recreational fishing and boating.

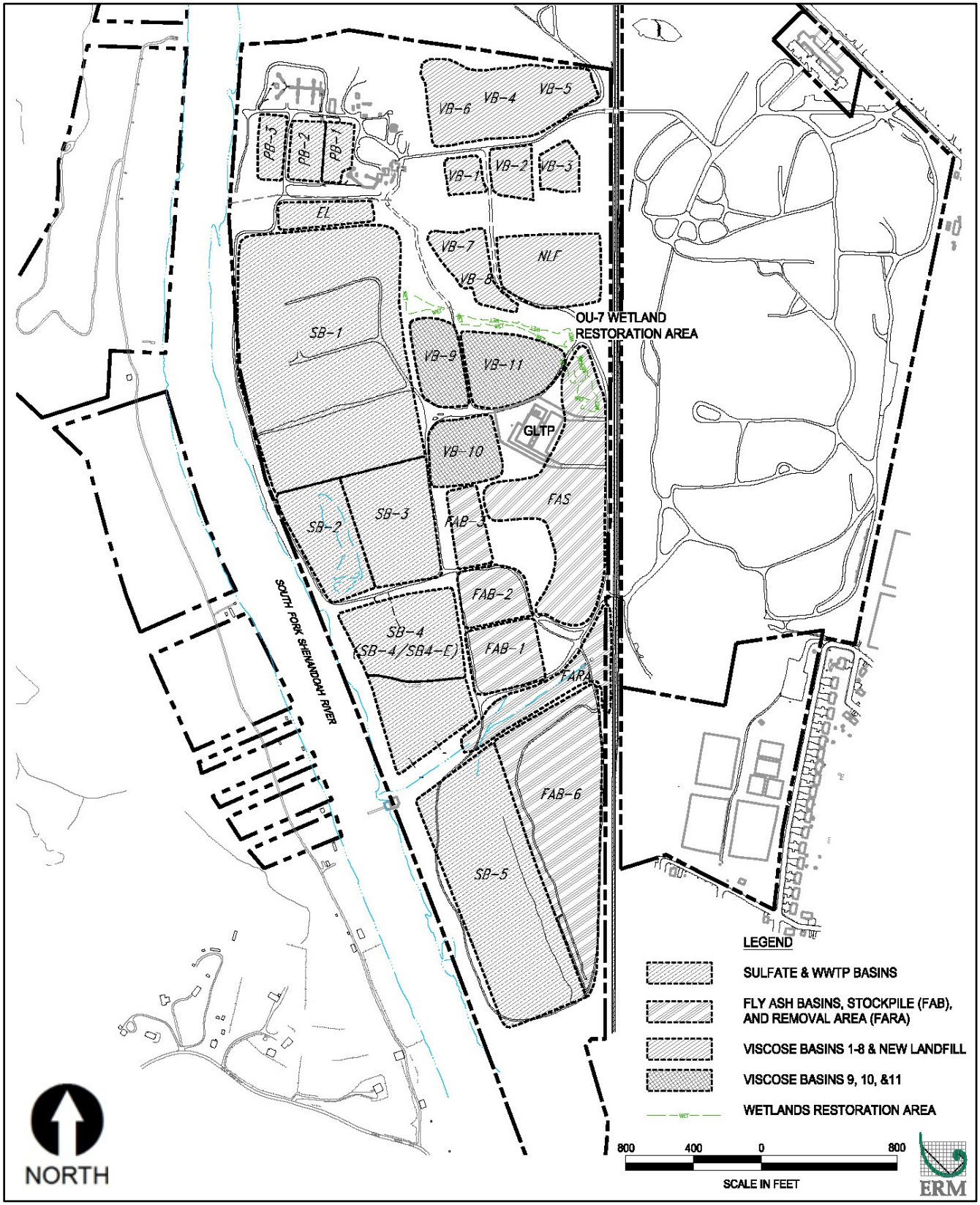
For reference, Appendix A includes a list of documents reviewed during this FYR. Appendix B includes a timeline of site events.

Figure 1. Site Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site. Groundwater and Leachate Treatment Plant (GLTP)

Figure 2. Site Waste Disposal Basins



Note: Figure above is Figure 1 from the Site's May 2015 Site-Wide Post-Closure Care Operation and Maintenance (O&M) Plan.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Avtex Fibers, Inc.		
EPA ID: VAD070358684		
Region: 3	**State:** Virginia	**City/County:** Front Royal / Warren
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Jeff Thomas, with additional support provided by Skeo		
Author affiliation: EPA Region 3		
Review period: 5/8/2017 – 3/26/2018		
Date of site inspection: 6/27/2017 – 6/28/2017		
Type of review: Statutory		
Review number: 5		
Triggering action date: 3/26/2013		
Due date *(five years after triggering action date)*: 3/26/2018		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

EPA added the Site to the Superfund program's National Priorities List (NPL) in 1986. In 1993, EPA and FMC entered into a Consent Order requiring FMC to thoroughly investigate the Site. In 1994, EPA and FMC completed a site wide Remedial Investigation (RI). The RI assessed buildings, sewers, waste disposal areas, on-site soil and groundwater.

EPA divided the Site into 10 OUs to manage the cleanup. EPA established OU6 and OU9 as administrative OUs to require building investigations and to require an ecological risk investigation and risk assessment. EPA addressed OU6 through a time-critical removal action (TCRA), which is discussed in the Response Actions section of this FYR. EPA addressed OU9 through the performance of the Site's 1999 Final Ecological Risk Assessment. It concluded that metals and PCBs posed an unacceptable risk to ecological receptors site wide. The remedies selected by the Site's decision documents addressed those ecological risks.[2] The following sections describe the basis for taking action for each non-administrative OU.

[2] There is no ROD for OU9. Ecological risks for the Plant Area Soils are discussed in greater detail in the Technical Assessment section.

OU1 and OU7 (groundwater and surface water contamination caused by leachate from VBs 9, 10 and 11):
In 1982, the Commonwealth of Virginia detected carbon disulfide in domestic water supply wells in the residential subdivisions across the South Fork Shenandoah River from the Site (Figure 1). Between 1983 and 1984, Avtex purchased 23 homes and residential properties that had domestic wells within the potentially degraded area of two subdivisions west of the river and began providing water to affected residences in that area.

A Remedial Investigation and Feasibility Study (RI/FS), performed by Avtex between August 1986 and August 1988, identified VBs 9, 10 and 11 as the primary source of groundwater contamination. Both overburden and bedrock groundwater are contaminated with contaminants of concern (COCs) similar to those found in the VB leachate, which include carbon disulfide and arsenic.

The risk assessment, performed as part of the OU7 RI, identified unacceptable risks associated with the following exposure pathways: inhalation of hydrogen sulfide and carbon disulfide from VB 9 for future residents and commercial worker exposure scenarios, and dermal contact with and ingestion of groundwater for future residents. The OU7 risk assessment identified carbon disulfide, arsenic and mercury as the primary risk drivers for groundwater. The RI did not identify any risks to human health associated with surface water in the South Fork Shenandoah River; however, samples collected during the low river stage identified potential risks to ecological receptors.

OU2 (PCB-impacted soil):
In 1989, sampling by the Virginia State Water Control Board identified PCBs in site soil and in fish tissue samples collected from the Shenandoah River. An explosion of an electric transformer in 1985 and maintenance practices at the former polyester drying area are thought to be the primary sources of PCBs at the Site. In May 1989, the Virginia Department of Health issued an advisory against consuming fish from the lower portions of the South Fork Shenandoah River, and the main stem of the Shenandoah River from Front Royal downstream to the West Virginia state line. Later that same year, EPA completed the RI and identified unacceptable human health risks associated with contact with PCB-contaminated soil and an immediate threat to the ecological receptors through the discharge of PCB-contaminated wastewater from the plant's sewer system to the river in the RI.

OUs 3, 4 and 5 (unstable buildings, site security and drummed waste):
The OU2 Record of Decision (ROD) determined that the acid reclaim building, drummed waste and the lack of site security posed potential physical safety and chemical hazards to on-site visitors and workers. The acid reclaim building also presented an obstacle to future site work.

OU8 (Areas B and C):
The 2000 ROD defined OU8 as soil associated with a 24-acre open field on-site, referred to as Area B, and a 10-acre paved parking area, referred to as Area C. In 1995, FMC investigated soil at site Areas A, B and C.[3] Area investigations identified shallow soil (0-2 feet) in Areas B and C as the only media of concern, but concluded that the soil does not pose a risk to human health based on an industrial/commercial land use scenario.[4] Risks associated with Area B and C shallow soil under other land use scenarios, such as residential use, have not been evaluated. The site's 1999 ecological risk assessment did not identify any unacceptable risks to ecological receptors in Areas B and C. The Site's 2012 Explanation of Significant Differences (ESD) renamed site Areas B and C as Areas 2B and 2A, respectively.

OU10 (VBs 1 through 8, the New Landfill (NLF), Plant Area Soils, Area A, and the WWTP):
VBs 1 through 8
The risk assessment performed as part of the 1994 Sitewide RI found that several compounds in soil/waste samples collected from the top 2 feet of VBs 1 through 8 exceeded EPA's Region 3 risk-based screening concentrations, based on individual soil exposure for future recreational, current site worker and trespasser use

[3] FMC addressed soil contamination at Area A as part of OU10 Plant Area Soils (discussed in the following FYR section).
[4] The site's OU8 ROD concluded that plant operations were not conducted in site Areas B and C. It also concluded that contamination discovered in those areas must have migrated or been transported from the manufacturing areas.

scenarios. The constituents that exceeded the risk-based screening concentrations included arsenic, lead, benzo(a)pyrene and dibenzo(a,h)anthracene. Several leachate constituents – lead, mercury and nickel – from the VBs exceeded Virginia Surface Water Quality Standards for human health.

The NLF
At the time of the 1994 Sitewide RI, wastes in the NLF were exposed and posed a direct contact risk to future recreational users and future construction workers. Arsenic concentrations in surface materials and adjacent soil exceeded the EPA Region 3 risk-based screening concentrations. The Site's 1999 Final Ecological Risk Assessment concluded that metals and PCBs pose a potential risk to ecological receptors at the NLF. The risk assessment also determined that arsenic concentrations in leachate from the NLF would pose a threat to groundwater quality if containment and collection of leachate were discontinued.

Plant Area Soils, Area A
The risk assessment performed as part of the 1994 Sitewide RI concluded that lead concentrations in Plant Area Soils presented an unacceptable risk to future workers. The Site's 1999 Final Ecological Risk Assessment concluded that metals and PCBs in Plant Area Soils pose a potential risk to ecological receptors at the NLF.

WWTP
While no specific risks were identified associated with the WWTP, according to the OU10 ROD, the WWTP previously treated stormwater and leachate generated by VBs 1 through 8 and the NLF.

Response Actions

In the 1988 OU1 ROD, EPA selected a remedy to address the groundwater contamination. The remedy called for the extraction and treatment of groundwater beneath and downgradient of VBs 9, 10 and 11. EPA subsequently suspended the OU1 remedy, pending the completion of a sitewide investigation (the 1994 Sitewide RI).

In 1989, Avtex, who had been struggling to remain solvent for many years, declared bankruptcy and ceased operations. EPA subsequently initiated emergency removal actions to prevent releases from reactive and dangerous materials left in tanks, piping and buildings.

In 1999, EPA entered into a Consent Decree with FMC in which FMC agreed to conduct all future response actions at the Site, including, but not limited to, a TCRA, two non-time-critical removal actions (NTCRAs), and the implementation of remedies to be selected by an OU7 ROD and an OU10 ROD. The sections below summarize those actions.

TCRA – Buildings (1994-2011)
EPA conducted building investigations (OU6) and evaluations in 1994 and 1996. The investigations identified large amounts of remaining chemicals, leaking pipes and vessels, and poor structural integrity of the Site buildings. In response to those findings, EPA completed the TCRA to demolish manufacturing buildings on-site. In September 1998, as part of a global settlement with EPA, FMC assumed responsibility for management of the demolition debris and waste materials, as well as management of wastewater and stormwater at the Site. FMC with EPA oversight, completed most of the demolition work in 2006, with some components incorporated into the NTCRAs and OU10 remedial action. EPA determined that the work was completed in September 2011.

NTCRA – Basins (2000-2014)
On January 31, 2000, EPA signed a Removal Action Memorandum for the closure of the basins. The goal of this removal action was to mitigate current and potential future risk to ecological receptors from direct contact with uncovered waste in the basins and to mitigate the release of contaminants that could potentially impact ecological receptors in the South Fork Shenandoah River. The cleanup plan called for consolidation of wastes on Site and provided for closure of the basins containing wastes using engineered protective caps or soil covers. Depending on the basin and its contents, the basin closures involved either covering with 2 feet of clean soil or construction of low-permeability caps. The basin cover systems prevent direct human and ecological exposure to wastes

consolidated within the basins, and geomembrane caps installed over some of the basins also prevent infiltration of water through wastes, reducing leachate generation and groundwater impacts. Table 2 below summarizes the cover systems for each of the NTCRA areas. The work also included installation of passive gas vents within the SB cover systems, vegetation of the basin covers with warm-season grasses and installation of stormwater drainage controls. FMC, with EPA oversight, began implementing the basin closure project in May 2001 and completed it in 2014. EPA approved FMC's Remedial Action Report and certification of completion for the Basins NTCRA in September 2015.

Table 2: Summary of NTCRA Basin Cover Systems

Basin/Area	Cover System
SB-1 cells 1 through 3 and cell 4 east, SB-3, SB-4 and the emergency lagoon	Combination of a geomembrane cap and a 2-foot clean soil cover
SB-1 cell 4 west, Fly Ash Basins (FABs) 1 through 3, FAB 6, fly ash removal area, and polishing basins (PBs) 1 through 3	2-foot soil cover system
SB-2 and Fly Ash Stockpile	Combination of 2-foot soil cover and clean closed*
SB-5	Clean closed*
Note: Figure 2 shows the locations of the basins listed above. *Clean closed = cover not required	

NTCRA – Buildings and Sewers (2002-2013)

Between January 2002 and December 2013, FMC performed a NTCRA to address site sewers and buildings that were not addressed under the previous Buildings TCRA. Cleanup involved decontamination of buildings, foundations, and aboveground and subgrade structures, as well as the removal of over 56,000 linear feet of sewers and 222 manholes. EPA approved FMC's Remedial Action Report and certification of completion for the Buildings NTCRA in December 2015.

Decision Documents

EPA selected long-term remedies in individual RODs for OU1, OU2, OU7, OU8 and OU10 and two ESDs. The OU2 ROD also established remedies for OUs 3, 4 and 5. OU6 and OU9 are administrative OUs and do not have RODs. Table 3 lists the remedies selected by each decision document and the associated remedial action objectives (RAOs).

Table 3: Decision Documents, Selected Remedies and RAOs

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
OU1 ROD (1988)	Groundwater contamination caused by leachate from VBs 9, 10 and 11	Extraction and treatment of contaminated groundwater, monitoring of on-site and off-site groundwater, surface water and basin fluids; and groundwater use restrictions. Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed the cleanup under OU7.	Not applicable. See OU7 ROD.

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
OU2, OU3, OU4 and OU5 ROD (1990)	PCB-impacted soil, the acid reclaim building, site security and drums	OU2 – PCB-impacted soils: Excavation and off-site disposal of 5,000 cubic yards of PCB-contaminated soil and restoration of excavated areas. OU3 – Acid reclaim building: Dismantling and demolition of the unstable acid reclaim building and associated equipment. OU4 – Continued site security, control, maintenance, and health and safety measures. OU5 – Identification and off-site disposal of 2,879 drums.	Mitigate potential risks to public health and the environment associated with wastes contained in drums, PCB-contaminated soil, the acid reclaim building and the lack of site security. Remove obstructions to future site investigations and remediation efforts.
OU8 ROD (2000)	Areas B and C[5]	Institutional controls to permanently restrict land uses to commercial/industrial.	Ensure that the reasonably anticipated future land use remains commercial/industrial in perpetuity.
OU10 ROD (2004)	VBs 1 through 8, the NLF, Plant Area Soils and the WWTP	VBs 1-8: Improvement of existing soil covers, leachate collection and treatment, and groundwater monitoring. The NLF: Construction of a soil cap, leachate collection and treatment, and groundwater monitoring. Plant Area Soils: Excavation of soil with contaminant concentrations above defined criteria, stabilization of soil deemed to be characteristically hazardous due to metals, off-site disposal of all treated and untreated soil with contaminant concentrations above specified groundwater protection standards and all soil containing 50 milligrams per kilogram (mg/kg) or greater of total PCBs, and either on-site or off-site disposal of remaining excavated soil.* The WWTP: Decontamination and demolition.	VBs 1-8 and the NLF: Prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants. Mitigate current and future potential risks to human health and ecological receptors associated with leachate from VBs 1-8 and uncovered leachate-contaminated soil. Control production and uncontrolled releases of gases from VBs 1-8 and the NLF. Plant Area Soils: Mitigate direct contact risks to humans and ecological receptors posed by contaminants in Plant Area Soils. Mitigate future human health and ecological risks associated with the potential migration of contaminants to surface water. Mitigate current and potential future risks associated with the migration of contaminants to groundwater. WWTP:

[5] The Site's 2012 ESD renamed site Areas B and C as Areas 2B and 2A, respectively.

Decision Document and Year	Associated Site Area(s)/Impacted Media	Selected Remedy	RAOs
			Remove the WWTP when it is no longer needed.
OU10 ESD (2006)	Plant Area soils	Expansion of the area being addressed as Plant Area Soils to include additional areas of concern, including soil in the Vicinity of the SoccerPlex, the Burnt Debris/Ash Area and the Coal Seam Area.	Prevent direct contact with soil containing contaminants above health-based levels.
OU7 ROD (2007)	Groundwater contamination caused by leachate from VBs 9, 10 and 11	Construction and operation of a groundwater extraction and treatment plant and a WWTP; capping and construction of a leachate extraction system for VBs 9-11; characterization, removal and disposal of contaminated sediment associated with seeps next to VBs 1, 10 and 11 and OU7 soil located outside of VBs 9, 10 and 11; institutional controls; provision of water to affected property owners on the west side of the South Fork Shenandoah River; annual monitoring of surface water, sediment and biota in the South Fork Shenandoah River; and post-closure monitoring and maintenance.	Prevent human exposure to contaminated groundwater that would result in unacceptable levels of risk. Prevent human and ecological receptor exposure through direct contact with waste in VBs 9-11. Mitigate risks from principal threat waste in VBs 9-11 through leachate treatment. Restore groundwater to its beneficial uses by reducing contaminant concentrations. Mitigate further releases to groundwater of hazardous substances from residual contamination in VBs 9, 10 and 11. Control and mitigate contaminated groundwater plume discharge to the river. Control the production and release of hazardous and/or noxious gases from VBs 9, 10 and 11 that can present an unacceptable risk or public nuisance.
OU7, OU8 and OU10 ESD (2012)	Areas B and C, VBs 1-8, the WWTP, the NLF, Plant Area Soils, and areas of contaminated groundwater	Modification of the Conservation Easement by replacing the existing easement with multiple Environmental Covenants to address multiple owners and property uses, and modification of Ecological Backfill Values with site-specific cleanup values.	The ESD did not establish new RAOs; it states that the modified remedy is consistent with the RAOs established by the OU7, OU8 and OU10 RODs.
* The remedy selected in the OU10 ROD does not require institutional controls. However, the OU10 ROD states that the Conservation Easement, implemented under OU8, as an institutional control will provide additional long-term protection.			

Clean Up Goals

EPA established cleanup goals for each affected media and corresponding area(s) in the decision documents listed above. Those cleanup goals are presented below, by OU. A compendium of the cleanup goals is included as Appendix C

OU2 Soil

The OU2 ROD established a soil cleanup goal for PCBs of 10 milligrams per kilogram (mg/kg). Table C-1 in Appendix C lists the OU2 Soil Remedial Goal for Total PCBs.

OU7

Groundwater

The OU7 ROD states that the remediation of groundwater at the Site will continue until the respective maximum contaminant levels (MCLs) for carcinogens and Maximum Contaminant Level Goals (MCLGs) for non-carcinogens for the COCs are attained and the excess cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 ($1x10^{-4}$) and the hazard index is reduced to 1 for each specific organ. For COCs without MCLs or MCLGs, Risk Based Cleanup Goals were established from EPA Region 3 risk-based tap water standards presented at cancer/hazard target benchmarks of 1x10-4 for carcinogens and 1 for noncarcinogens. Table C-2 in Appendix C lists the groundwater cleanup goals established by the OU7 ROD.

Soil

The OU7 ROD required characterization of OU7 soil located outside the basins that would not be covered by the VB 9, 10, and 11 cover systems. All soils and sediments classified as hazardous waste were to be disposed of at an off-site Resource Conservation and Recovery Act Subtitle C landfill. All non-hazardous soil and sediment that met groundwater protection standards but exceeded the regional screening levels (RSLs) for industrial soil at a total excess cancer risk of $1x10^{-5}$, a total non-cancer risk for target organ-specific HQ of 1, and/or EPA's Region 3 Ecologically Protective Backfill Values, as listed in Table 11 of the OU7 ROD, were to be excavated and placed in the basins under the cap.

Following the OU7 ROD, EPA determined that the original Ecologically Protective Backfill Values for aluminum, iron, manganese, mercury and zinc were lower than naturally occurring regional background levels. Therefore, EPA concluded that remediation of soil below background levels to meet the original standards in Table 11 of the OU7 ROD, for those five metals would be extremely difficult to achieve. Table 4 lists the modified, site-specific OU7 soil cleanup goals established by the 2012 Second ESD (2012 ESD) for those five metals. Table C-3 in Appendix C list the soil cleanup goals established by the OU7 ROD and modified by the 2012 ESD.

Table 4: Modified Ecologically Protective Cleanup Values for Five OU7 Soil COCs

COC	Modified 2012 ESD Ecologically Protective Backfill Cleanup Values (mg/kg)
aluminum	20,200
iron	31,700
manganese	441
mercury	0.14
zinc	233
pH*	5.5 standard units
* The 2012 ESD also added an additional OU7 soil performance standard to address the acidic nature of site soil. The ESD requires that the upper 6 inches of cover soil in remediated areas be amended as needed to achieve a pH of no less than 5.5 prior to seeding/replanting.	

Surface Water, Sediment and Biota
The OU7 ROD did not establish cleanup goals for surface water, sediment or biota. It states that annual sampling of surface water, sediment and biota in the South Fork Shenandoah River will be conducted to determine if there are decreasing trends in the concentration of contaminants. The Site's February 2015 Revised Surface Water and Sediment Monitoring Plan for OU7 established screening criteria for surface water and sediment. Screening criteria for naphthalene is based on EPA Region 3 Biological Technical Assistance Group Aquatic Freshwater Screening Levels. The Plan established the EPA Region 3 Freshwater Sediment Screening Benchmarks as the sediment screening criteria.

Air
The OU7 ROD established an air sampling and monitoring program to be implemented during the remedial action to ensure that air emissions from the VB 9, 10 and 11 vents do not: 1) result in air concentrations that pose an unacceptable risk by exceeding the $1x10^{-5}$ risk level for carcinogens or a hazard quotient (HQ) of 1 for non-carcinogens; 2) pose an ignition or explosion hazard; and 3) pose nuisance odor issues with off-site residences or area users.

OU10 Soil
The OU10 ROD established soil cleanup goals based on both direct contact and protection of groundwater. Soil from 0-10 feet below final grade shall meet the direct contact human health standards and the groundwater protection standards. The OU10 ROD established a direct contact soil cleanup goal for PCBs of 25 mg/kg. Soil deeper than 10 feet shall meet the groundwater protection standards only.

The soil cleanup standards for groundwater protection are based on non-zero maximum contaminant level goals (MCLGs). In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. See Appendix I for information regarding how to screen soil samples against the soil cleanup goals for protection of groundwater. Table C-4 in Appendix C lists the soil cleanup standards for the Plant Area Soils established by the OU10 ROD.

Following establishment of the OU10 Plant Area Soils boundaries by the OU10 ROD, FMC discovered contaminated soil at three areas outside the initially established OU10 boundary. The newly identified areas were within the parcel now occupied by the SoccerPlex (Figure 1). In 2004, FMC completed the Remedial Investigation of the Proposed Skyline SoccerPlex to supplement the 1994 Sitewide RI. The 2004 RI identified a 3-acre part of the proposed SoccerPlex property that may have been contaminated by site activities. The 2004 RI referred to the area as the "Soils in the Vicinity of the SoccerPlex." Subsequent grading activities identified two more areas of potential concern on the proposed SoccerPlex property, which became known as the "Burnt Debris/Ash Area" and the "Coal Seam Area." Sampling identified elevated concentrations of lead, arsenic and other metals in the surface soil in the Vicinity of the SoccerPlex and Burnt Debris/Ash Areas, and a material with a coal-like appearance at the Coal Seam Area. The Site's 2006 OU10 ESD established soil cleanup goals for the three areas and defined the entire area as the Expanded Plant Area Soils. To facilitate future recreational use of the Expanded Plant Area Soils area, EPA selected risk-based soil cleanup goals based on future residential use. The ESD established a total PCB soil cleanup goal for the Expanded Plant Area Soils of 1 mg/kg.

Table C-5 in Appendix C lists the residential soil cleanup standards for the Expanded Plant Area Soils established by the 2006 OU10 ESD. Figure J-1 in Appendix J shows the location of the Expanded Plant Area Soils.

Status of Implementation

Prior to the 1999 Consent Decree, EPA completed parts of the selected remedies for OU2, OU3, OU4, and OU5, as established by the 1990 ROD, as removal actions and remedial actions to address immediate threats to human health and the environment. Following the 1999 Consent Decree, FMC conducted the remedial actions established by subsequent RODs and ESDs. Remedy implementation for each non-administrative OU is described below.

OU1
Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed cleanup of groundwater contaminated by VBs 9-11 under OU7.

OUs 2, 3, 4 and 5
The 1990 ROD selected remedies to address OUs 2 through 5. EPA and FMC completed the required remedial actions for those OUs as described below.

OU2:
Between March 1991 and January 1992, EPA excavated and disposed of 5,000 cubic yards of PCB-contaminated soil off site.

OU3:
Between March 1991 and September 1993, EPA dismantled and demolished the unstable acid reclaim facility.

OU4:
EPA started providing site security in July 1991; FMC took over site security in October 1999.

OU5:
In September 1994, EPA identified and disposed of 2,879 drums off site.

OU7
FMC completed the final OU7 remedial design in October 2011 and performed the OU7 remedial action between 2011 and 2015. Pre-design activities in 2010 included characterization, excavation and disposal of contaminated sediment associated with seeps next to VBs 1, 10 and 11 and OU7 soil located outside of VBs 9, 10 and 11; installation of a bridging layer on VBs 9, 10 and 11 with leachate extraction; additional fill to support the cap on top of the bridging layer and bench-scale testing for the GLTP. In 2012, FMC constructed a geomembrane cap over VBs 9, 10 and 11; installed a passive landfill gas venting system (passive gas vents (GVs) GV-1 through GV-11) to reduce the accumulation of gas beneath the cap; covered the cap with soil; and seeded the area. Remedy construction also included the installation of stormwater management controls for VBs 9-11 and vegetation of the caps with cool- and warm-season grasses and wetland species.

The OU7 leachate extraction system removes leachate from VBs 9, 10 and 11 and conveys it to the GLTP. Construction included the installation of 30 leachate extraction wells (10 per VB) and associated conveyance lines, and construction of the VB Building to house the extraction system pumps and controls, compressors and other associated components. The VB Building is ventilated and is continuously monitored for gases of concern. FMC constructed the Site's leachate extraction system between 2013 and 2014. The leachate extraction system includes the VB 9-11 leachate extraction wells, four lift stations and associated conveyance systems. The lift stations pump leachate from different areas on the basin/western half of the Site to the GLTP via underground conveyance pipes.

Between 2011 and 2013, FMC installed three bedrock groundwater extraction wells, two on the east side of the river and one on the west side. A lateral bedrock conveyance line, drilled beneath the river, conveys groundwater from the 400-foot-deep well on the west side of the river to the GLTP. FMC constructed the GLTP between 2012 and 2014. The GLTP design includes an enclosed leachate tank with an air scrubber to control odors. The system blends the leachate with contaminated groundwater in an enclosed 192,000-gallon equalization tank. The treatment train includes bag filters to remove solids, equalization, metal precipitation, biological treatment, multi-media filtering, and granulated activated carbon filtering. The system processes solids/sludge through a filter press. The solids are disposed of off-site and the system's effluent discharges to the South Fork Shenandoah River under a NPDES permit. The GLTP began full operation in mid-2015. Remedy construction included the installation of tall chain-link fence around the GLTP and VBs 9-11 to restrict unauthorized access to those areas. Institutional controls are in place for OU7 and are discussed in the Institutional Control Review section. EPA approved FMC's Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate

Extraction Components of OU7 in September 2015. As required by the OU7 ROD, FMC provides water to the three residences on the west side of the river. FMC fills cisterns at those properties with clean water that can be used for both potable and non-potable purposes, such as irrigation. The OU7 ROD states that none of the privately owned parcels west of the river have drinking water wells. EPA confirmed this by contacting the Virginia Department of Health in Warren County, during the preparation of this report, and requesting a subject parcel search. The Virginia Department of Health responded that the subject parcels do not have an active well or permit for a well currently requested.

OU8

The selected remedy for OU8 includes institutional controls for Areas B and C. The implementation of the OU8 remedy is discussed in the Institutional Control Review section below.

OU10

FMC, in accordance with the 1999 Consent Decree, performed the OU10 remedial action, as established by the OU10 ROD and subsequent 2006 ESD, between 2004 and 2014. The following sections describe the different components of the OU10 remedy.

VBs 1-8 and the NLF

The remedy for VBs 1-8 included capping of the basins with a geosynthetic cap and 2 feet of soil, and the installation of 25 passive gas vents. FMC capped the basins in 2008 and 2009 and completed seeding of the final covers in 2010. The Site's leachate extraction system conveys leachate generated by VBs 1-8 to the GLTP for treatment. The remedy also included installation of stormwater drainage controls.

Due to historically high levels of hydrogen sulfide and other gases, FMC installed carbon filtration units at vents OU10 GV-4 and OU10 GV-5 in the spring of 2014. The units treat vapors from the vents and prevent exposure to hazardous vapors.

The NLF is a 2.75-acre landfill that stands about 40 feet tall from base to peak. The landfill closure complies with the Virginia Solid Waste Management Regulations for closure of a non-hazardous industrial waste landfill (9 Virginia Administrative Code Section 20-80-207E). The landfill cap includes a geosynthetic liner with a 2-foot soil cover and four passive gas vents. The monitoring well network for VBs 1-8 and the NLF includes 19 monitoring wells. FMC completed landfill closure in July 2012.

Plant Area Soils

FMC performed the Plant Area Soils remedial action between 2004 and 2012. Cleanup of soil characterized as hazardous waste due to lead contamination involved stabilization and placement beneath the cap of the NLF. FMC placed PCB-contaminated soil (concentrations between 25 mg/kg and 50 mg/kg) and soil above direct human contact health standards in basins and landfill closures below the impermeable layer. Soil exceeding the groundwater protection standards was disposed of off-site in an appropriately permitted Transportation, Storage, and Disposal Facility (TSDF).

FMC conducted a cleanup evaluation of the OU10 Plant Area Soils and NTCRA – Buildings soils in 2012. The evaluation concluded that the remedial actions performed at those areas met the established cleanup goals. The Remedial Action Report was approved by EPA in May of 2015.

Expanded Plant Area Soils

In accordance with the Site's 2006 OU10 ESD, FMC excavated Expanded Plant Area Soils with COC concentrations above residential soil cleanup goals and disposed of them off-site, in an appropriately permitted TSDF or on-site in areas to be capped, depending on the level of contamination. Before collecting soil samples from the Vicinity of the SoccerPlex area, FMC excavated about 2,000 cubic yards of soil from the area with visual evidence of fly ash or coal fines, characterized it, and put it in the NLF. Subsequent samples demonstrated that soils in the area do not pose an unacceptable risk to human health or the environment, and that additional

remediation was not required. EPA concurred with this finding and approved the remedial work in a June 7, 2012 letter to FMC.

The Burnt Debris Area contained inert construction debris, black ash, viscose material, rayon fiber and other burnt debris. A composite sample of the material indicated it was characteristically hazardous for lead and had elevated concentrations of other metals. Cleanup included excavation of 1,513 tons of lead-contaminated soil and debris and off-site disposal. Post-excavation soil samples confirmed that the underlying and adjacent soil met the cleanup standards, and no further remediation was necessary. EPA concurred with these findings and approved the remedial work in an August 7, 2006 letter to FMC.

Sampling of the Coal Seam Area determined that the coal seam material and layer of rubble do not pose an unacceptable risk to human health or the environment; therefore, remediation was not required. EPA concurred with this finding in a March 19, 2007 letter to FMC. In 2015, EPA approved FMC's Remedial Action Report for the Plant Area Soils Component of Operable Unit 10.

WWTP

In accordance with the Site's 2012 EPA-approved work plan, FMC demolished the WWTP in 2013. Inert debris from the WWTP was disposed of either on-site in subgrade structures or off-site in an appropriately permitted landfills or scrap metal recyclers. The demolition removed aboveground structures except for a tin storage building that FMC retained for storage of operation and maintenance (O&M) equipment.

In June 2014, FMC documented the completion of OU10 remedy construction in a Remedial Action Report. In September 2015, EPA approved FMC's Remedial Action Report for OU10.

Institutional Control Review

In November 1999, the EDA purchased the site property from the Avtex Bankruptcy Trustee pursuant to a Real Estate Sale Contract, which included a contingency of execution of a Prospective Purchaser Agreement (PPA). The PPA was executed and became effective March 2000. The purchase included the 428-acre Site and about 69 acres of land on the west bank of the South Fork Shenandoah River. Since that time, small parts of the Site have been acquired by different parties, including the town of Front Royal and Warren County.

The OU7 ROD required Institutional Controls to maintain and protect the integrity of the remedy and to prevent installation of drinking water supply wells where groundwater contamination exceeds cleanup goals. The OU7 ROD also requires the development of an Institutional Control Implementation and Assurance Plan (ICIAP). At the time of this FYR, FMC is preparing the ICIAP to identify Institutional Controls, how the controls are, or will be implemented and how they will be monitored over the long term. The ICIAP will also identify reporting requirements associated with each Institutional Control and include, at a minimum, a requirement for annual review of the status, effectiveness and appropriateness of the institutional controls.

The OU8 ROD required institutional controls to permanently restrict land use of Areas B and C (Former Plant Side: Areas 2, 2A and 2B) to commercial or industrial uses. In December 1999, several parties entered into a Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants (Conservation Easement) for Areas B and C, to meet the OU8 institutional control requirement. The town of Front Royal has also zoned Areas B and C for industrial land use.

The Site's 2012 ESD selected multiple environmental covenants as part of the remedy to replace the existing conservation easement to address multiple owners and property uses. Except for a few properties on the west side of the river (discussed below), the multiple covenants addressed the entire Site (Figure 3). In 2014, FMC, site property owners and the Clean Water Project entered into four different Virginia Uniform Environmental Covenant Act (UECA) Environmental Covenants. In 2014, Honeywell International Inc. entered into a Virginia UECA Environmental Covenants for the property north of the site known as Area 5 (Figure 3). Work at the Honeywell site was completed by Honeywell with oversite by the EPA Removal Program, and was not part of the

Avtex Superfund Site. However, due to proximity and similar site restrictions, the covenants are loosely connected. The covenants run with the land, restrict land use (e.g. light commercial/industrial use), prevent specific land uses (e.g. schools), place restrictions on soil excavation, and prohibit the extraction and use of groundwater and the installation of groundwater wells. The covenants also prohibit activities that could adversely affect the integrity of the remedy and grant EPA and VA DEQ access to the Site property to carry out remedy-related activities. The five covenants were recorded with the Warren County Clerk's Office on September 17, 2014. An example of one the covenants is in Appendix F.

One of the five covenants applies to the basin side of the Site and part of the Site on the west bank of the river, referred to as West Bank Acres (Instrument 140004560). The West Bank Acres area subject to the covenant includes only the property parcels owned by the EDA; it does not include privately owned parcels on the west bank of the river that overlie the groundwater plume, or that are located near the plume (Figure 3). FMC provides potable water to three private property owners on the west side of the river. At the time of the OU7 ROD, none of the private properties west of the river had drinking water wells. However, there are no groundwater use restrictions in place for privately-owned parcels located above the groundwater plume west of the river to prohibit the installation of new water supply wells. Installation of new private wells at those privately-owned parcels could potentially affect the direction of plume migration, and potentially result in unacceptable exposures if the water was used for potable purposes.

While not required by the ROD, a May 1989 Virginia Department of Health fish advisory remains in effect. It advises against consuming fish from the lower portions of the South Fork of the Shenandoah River, and the main stem of the Shenandoah River from Front Royal downstream to the West Virginia state line.

Table 5 shows the implemented institutional controls for the different site media, as well as the tax map identification numbers for the privately-owned parcels west of the river for which institutional controls are not in place. Figure 3 illustrates the status of institutional controls at the Site.

Table 5: Summary of Institutional Controls (ICs)

Media, Engineered Controls and Areas that Do Not Support UU/UE Based on Current Conditions	Impacted Area(s)	IC Objective	Title of IC Instrument Implemented and Date
Groundwater	Areas 1, 2, 2A, 2B, 3, 4 and 5, as shown in Figure 3	Prevent the installation of drinking water supply wells in the area where groundwater contamination concentration exceeds cleanup goals and prohibit the extraction and use of groundwater.	UECA Environmental Covenants for the Site's five areas, recorded 9/17/2014
	Privately owned properties west of the river that overlie the groundwater plume. Tax map identification numbers: 19F 1 59, 19F 1 57, 19F 1 56, 19F 1 54, and 19 90B. May also include additional privately-owned parcels along the river where installation and pumping of new water wells could affect plume migration.		ICs not in place

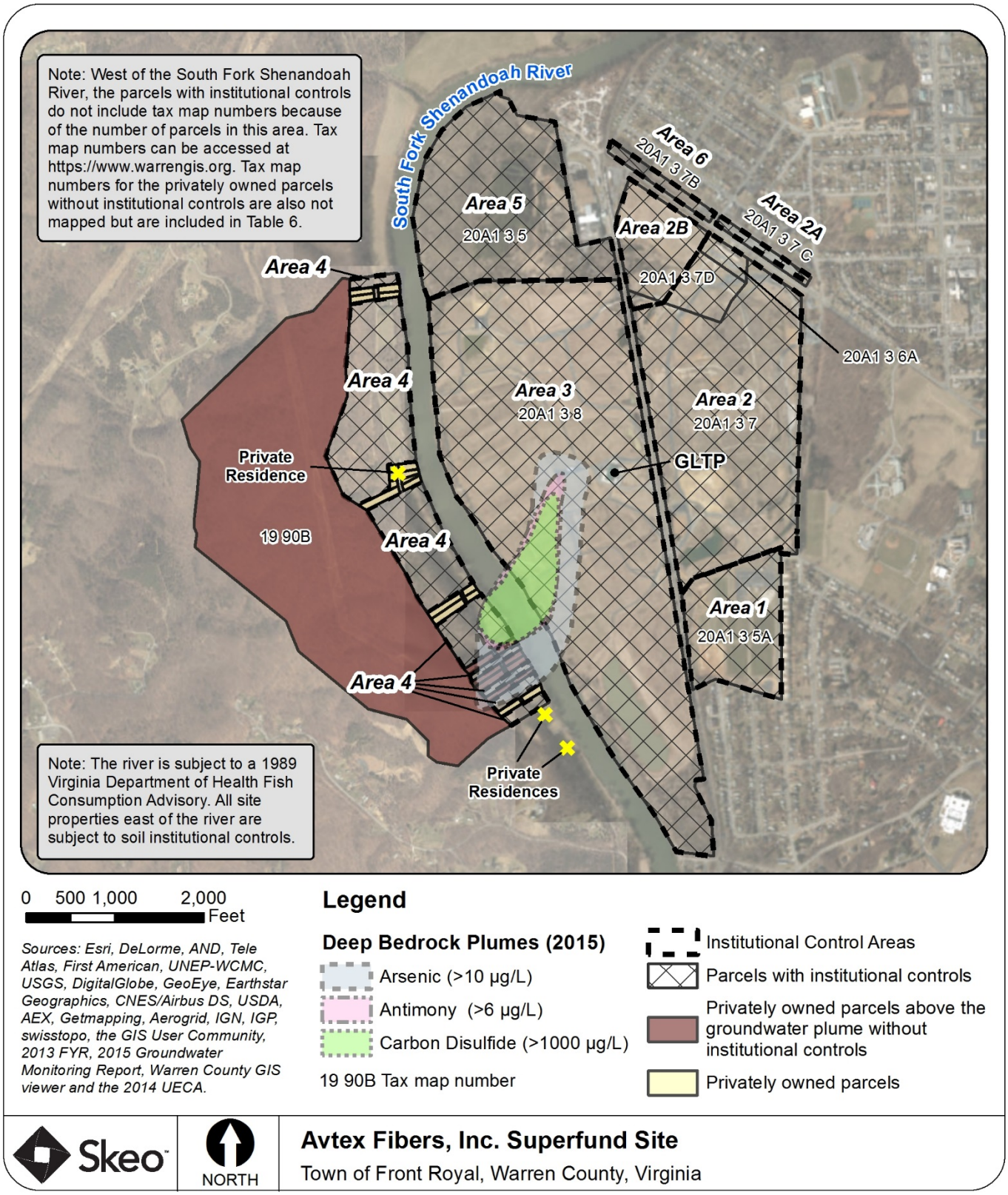
Media, Engineered Controls and Areas that Do Not Support UU/UE Based on Current Conditions	Impacted Area(s)	IC Objective	Title of IC Instrument Implemented and Date
Soil	All site areas depicted in Figure 3, east of the river	Restrict land use to either commercial/industrial, recreational, conservancy or open space depending on-site area; prohibit activities that could adversely impact the integrity of the remedy (which includes excavation at certain site areas); restrict other certain land uses depending on-site area.	UECA Environmental Covenants for the Site's five areas, recorded 9/17/2014

Table 6: Summary of UECA Environmental Covenants

Environmental Covenant Instrument Number	Grantor	Grantee	Site Area Subject to the IC (see Figure 3)	Tax Map ID Numbers	Restrictions
140004561	Industrial Development Authority of the Town of Front Royal and the County of Warren, VA	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side: Area 2 and Areas 2A and 2B	20A1 3 7, 20A1 3 7C, 20A1 3 7A, and 20A1-3-6A	Restricts land use to light commercial and industrial use; prohibits excavation of any soil from Borrow Area A; and prohibits excavation of soil 10 feet below the elevations depicted in attachment C of the IC (Appendix F); prohibit groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes
140004562	Warren County	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side – SoccerPlex: Area 1	20A1 3 5A	Restricts land use to recreational or public park use and associated parking lots only; prohibits residential dwellings of any kind; prohibits construction of any permanent or temporary building or structures on the property (with the exception of SoccerPlex-related infrastructure); prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes.
140004563	Town of Front Royal	FMC Corporation and The Clean Water Project, Inc.	Former Plant Side – Area 6	20A1 3 7B	Restricts land use to light commercial and industrial use; prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes.
140004560	Industrial Development Authority of the Town of Front Royal and the County of Warren, VA	FMC Corporation and The Clean Water Project, Inc.	Basin Side: Area 3 (Conservancy and Open Space) and Area 4 (West Bank Acres)	20A1 3 8 and several EDA-owned parcels west of the river	Prohibits residential dwellings of any kind; prohibits construction of any permanent or temporary building or structures on the property (with the exception of buildings that are customary and appropriate for park and recreational usage or those necessary for protection of human health or the environment, or constructed by EPA or FMC to implement response action); prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits activities that could impact the integrity of the remedy; grants EPA and VA DEQ rights of access to the property for remedial purposes; restricts the Conservation and Open Space Area of the property (Area 3) to conservancy and open space but may permit particular activities as specified in the Environmental Covenant; restricts the West Bank Acres area of the property (Area 4) to public park and recreational uses.

Environmental Covenant Instrument Number	Grantor	Grantee	Site Area Subject to the IC (see Figure 3)	Tax Map ID Numbers	Restrictions
140004559	Honeywell International Inc.	The Clean Water Project, Inc.	Basin Side – Honeywell: Area 5	20A1 3 5 and 20A1-3-6	Prohibits groundwater extraction and use, except as may be required by EPA or VA DEQ for remedial purposes; prohibits the installation of groundwater wells unless approved in writing by EPA; prohibits residential dwellings of any kind; restricts the part of the property located within the 100-year floodplain to conservancy, open space and park usage only; prohibits construction of any permanent or temporary building or structures within the flood zone (with the exception of buildings that are customary and appropriate for park usage).
Note: The restriction descriptions above do not include all restrictions outlined in each Environmental Covenant; they describe the restrictions that are most relevant to the protection of the selected remedy and that serve to prevent unacceptable exposure to site-related contamination.					

Figure 3: Institutional Control Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site. The plume maps are based on Appendix H – Figure H-29.

Systems Operations/Operation & Maintenance (O&M)

In accordance with the Site's 2015 Sitewide Operations and Maintenance Plan, PRP contractor Parsons prepares and submits annual sitewide O&M reports to EPA. The Sitewide O&M Plan includes three parts. Part one addresses the landfill and basin cover systems. Part two addresses the groundwater and leachate extraction systems. Part three addresses the GLTP.

The sections below summarize the Site's O&M activities and any noteworthy O&M-related events since the previous FYR. The Site transitioned into the O&M phase on December 30, 2015.

Landfill/Basins Cover System

Part 1 of the Sitewide O&M Plan requires the following O&M activities:

- Post-closure inspection of the final cover.
- Monitoring and maintenance of passive gas vents and gas vent filter systems.
- Routine maintenance and repairs to maintain the effectiveness and integrity of the final cover system.
- Procedures to be followed in the event of catastrophic events.
- Documentation and reporting.

Since the previous FYR, no significant O&M issues, besides the installation of the discussed gas vent filter system, have been noted. Typical minor O&M observations include bare spots, small trees, minor erosion and small areas of standing water. Parsons addresses those types of minor issues upon discovery.

Topographical Surveys

In lieu of using settlement markers, the O&M Plan requires an annual land surface topographic survey of the cover systems. Surveys were performed in 2015 and 2016; the results were compared to the 2014 baseline results. In most areas, settlement has been less than 0.5 feet per year. The 2015 and 2016 surveys reported widespread settlement at the NLF, but concluded that the NLF cap appears to be settling relatively uniformly and within expected tolerances to maintain a gradient sufficient to shed precipitation.

Wetlands

The OU7 remedy included an area of wetland restoration. The sitewide O&M Plan requires annual monitoring of the wetland restoration area for five full growing seasons after its construction and planting (from 2014 through 2018). The 2014-2016 surveys have identified small populations of invasive species. However, the reports conclude that a combination of mowing, spot treating with herbicide and continued monitoring are expected to help control these species. Overall, the surveys indicate that the wetland restoration area is becoming established with wetland vegetation.

Gas Vents

In accordance with the sitewide O&M Plan, the PRP's contractor(s) performs quarterly monitoring and inspections of the passive gas vents associated with OU7, OU10 and the NTCRA Basins. The 2016 sitewide O&M Report noted that several passive vents are slightly tilted, ranging from five to 20 degrees from vertical. However, the report concluded that the tilting of the vents does not impact their operation. The PRP contractor will continue to monitor the vents and will repair them if further damage may inhibit their ability to function. The PRP contractor will continue to monitor the inline carbon filtration units to determine when break through occurs on the primary unit. Once break though occurs, the secondary unit transitions to the primary unit and a new secondary unit is installed. The spent unit is transported for recharge and disposal at an approved treatment facility.

Groundwater and Leachate Extraction System

The groundwater and leachate extraction system includes three primary components: the VB 9-11 leachate extraction system, the OU10 and NLF leachate conveyance system (lift stations), and the OU7 groundwater extraction system. The Site's supervisory control and data acquisition system tracks and monitors system operations. In 2016, the VB extraction wells were out of operation for a few months to replace the pumps.

Otherwise, since startup, the system has operated as designed with minimal down time. An equipment maintenance program is used to record routine and non-routine maintenance activities and repairs. Parsons, the PRP's contractor, prepares and submits quarterly reports that summarize operation of the groundwater and leachate extraction system. Per the sitewide O&M Plan, Parsons samples the extracted VB leachate and groundwater to monitor and track any changes in the leachate characteristics. In general, concentrations of leachate constituents have either decreased or remained relatively stable since system startup. Table H-10 in Appendix H presents the Leachate Sample Results Summary for 2015 and 2016.

Groundwater and Leachate Treatment Plant

The GLTP treats a range of constituents, including, but not limited to, organic content, metals, chlorobenzene, chloroform, 2,4-dimethylphenol, carbon disulfide, ethylbenzene, methylene chloride, phenol, toluene and trichloroethene. The design flow rate for the plant is 125 gallons per minute. The GLTP discharges effluent at Outfall 004 directly to the South Fork Shenandoah River in accordance with the plant's NPDES permit. Parsons reports discharge monitoring results to VA DEQ each month in Discharge Monitoring Reports. There were no permit exceedances in 2015 or 2016. In 2016, the GLTP discharged 31.95 million gallons of water to the river or an average of 88,000 gallons per day.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the current status of those recommendations.

Table 7: Protectiveness Determinations/Statements from the 2013 FYR

OU #	Protectiveness Determination	Protectiveness Statement
2	Protective	The remedial action for OU-2 has been completed and the remedy is protective because the cleanup level for PCBs of 10 ppm was achieved in the area of concern.
8	Protective	The institutional control for Areas B and C called for in the ROD is being implemented through the Conservation Easement. The Conservation Easement can be enforced by EPA, the Lord Fairfax Soil and Water Conservation District and the Valley Conservation Council. The ROD 3 for Areas B and C is considered protective.
10	Short-term Protective	The major components of the remedy are substantially complete. The Plant Area soils were remediated to the cleanup levels established in the ROD. In addition, a risk evaluation was conducted comparing the concentration of contaminants in the existing soils to the April 2012 RSLs. This evaluation demonstrated that the plant area soils are protective for an industrial/commercial scenario. To ensure that the plant area soils remedy is protective to the current ecological receptors, an ecological assessment is warranted. Viscose Basin 1-8 and the New Landfill have been graded, capped, and seeded preventing exposure. The WWTP is scheduled for demolition in 2013.

Table 8: Status of Recommendations from the 2013 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
OU7	Some groundwater monitoring wells are routinely sampled and inspected, while others may be neglected.	Develop and implement a comprehensive groundwater monitoring well evaluation plan. Implement the recommendations of the plan.	Completed	In response to this FYR recommendation, FMC performed a sitewide wellfield inspection in November 2012. It identified several wells in need of repairs and that needed to be properly abandoned. With EPA approval, between December 2013 and February 2014, FMC abandoned 13 monitoring wells, two unknown wells and one deep bedrock well in accordance with VA DEQ specifications. FMC contracted A-Zone Environmental Services and Eichelbergers, Inc. to repair 103 wells identified during the well inspection. The contractors performed the work between January and April 2014. Environmental Resources Management prepared the May 30, 2014 Monitoring Well Repair and Abandonment Report to document the well abandonments and repairs on behalf of FMC.	May 30, 2014
OU7, OU10	There is insufficient information to confirm that air emissions do not present an unacceptable risk.	Collect gas vent data and incorporate into an air model to determine risk and potential for nuisance odors on-site and off site. If risks are unacceptable, apply emission controls to the vents to capture or destroy contaminants. In lieu of air modeling analysis, install air pollution controls proactively.	Completed	In accordance with the sitewide O&M Plan, FMC monitors gas vents for methane, volatile organic compounds (VOCs), hydrogen sulfide, lower explosive limit (LEL), carbon monoxide and oxygen. FMC documents the monitoring results in annual O&M reports. Due to historically high levels of hydrogen sulfide and other gases, in the spring of 2014, FMC installed carbon filtration units at OU10 GV-4 and OU10 GV-5. The units treat vapors from the vents and prevent exposure to hazardous vapors. FMC changes the filters based on monitoring results and if nuisance odors are observed. The gas vent data have not been incorporated into an air model to determine risk. However, the previous FYR recommendation states that in lieu of air modeling analysis, air pollution controls could be installed proactively. The installation of the filtration units at OU10 GV-4 and OU10 GV-5 is an example of the installation of proactive air pollution controls.	Spring 2014

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
OU10	The former Plant Area is currently vacant and an ecological assessment is necessary to determine if the remedy is protective of ecological receptors.	Conduct an ecological assessment.	Ongoing	In response to this issue, FMC completed a screening-level ecological risk assessment (SLERA) for the former Plant Area Soils part of OU10 in December 2014. The SLERA found that several chemicals of potential ecological concern are present in soil and sediment within the area evaluated at concentrations that exceed ecological screening levels, including bioaccumulative chemicals of potential ecological concern such as mercury and PCBs. EPA provided FMC with review comments on the SLERA in August 2015. EPA noted that several aspects of the assessment need to be further and more thoroughly addressed. EPA concluded that while future use of the area is intended to be industrial/commercial, the potential for unacceptable ecological risk exists until any redevelopment is carried out. A more detailed discussion of the SLERA is included in the Technical Assessment section.	Ongoing

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by newspaper posting in the Warren Sentinel on November 16, 2017. It stated that the FYR was underway and invited the public to submit any comments to EPA. A copy of the press notice is included in Appendix K. The results of the review and the report will be made available at the Site's information repository, Samuels Public Library, located at 330 East Criser Road in Front Royal, Virginia, and online at: https://www.epa.gov/superfund/search-superfund-five-year-reviews.

EPA interviewed VADEQ RPM Michelle Payne on February 23, 2018. Ms. Payne expressed that the remedy was functioning as intended and that the State was not aware of any complaints nor aware of any changes that would affect the remedy. EPA also interviewed EDA Director Jennifer McDonald on February 14, 2018. Ms. McDonald did not express any concerns related to the protectiveness of the site and felt that the site redevelopment was slowly progressing as intended. Interviews forms are included in Appendix K.

Data Review

This data review evaluates groundwater, surface water, sediment and aquatic biota data collected as part of long-term monitoring requirements for OU7, OU10 and the NTCRA basins and presented in the 2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins Report (2015 Annual Report). Appendix H presents a detailed data review, which includes data tables and figures. A summary of the data review is presented below. FMC submitted the 2016 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins on January 8, 2018. EPA is currently reviewing the submitted report. The initial review indicates that the 2016 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins is consistent with the 2015 Report.

OU7

Groundwater

The purpose of the OU7 groundwater monitoring program is to monitor groundwater elevations and quality to evaluate remedy performance and to support plume capture zone analyses, and to monitor groundwater quality for the closed VB 9-11 units in accordance with the Virginia Solid Waste Management Regulations (VSWMRs). Figure H-1 in Appendix H shows the locations of the wells in the OU7 monitoring program in each of four flow zones: overburden, shallow bedrock, intermediate bedrock and deep bedrock. Figure H-1 also shows pumping wells TW-01, TW-02 and TW-03, which began consistent operation in June, March and August 2015, respectively. Figures H-26 through H-29 also present 2015 groundwater elevation contours for the flow zones as well as isoconcentration contours for carbon disulfide, arsenic and antimony, the most widespread COCs. This FYR evaluates the groundwater data collected in 2015 in detail and presents limited historical data to provide context for the evaluation. Table H-5 in Appendix H presents a summary of the 2015 sampling results.

2015 Capture Zone Analysis

PRP contractors collect water level data on a quarterly basis to support capture zone analyses. In support of the 2015 Capture Zone Analysis (CZA), the OU7 monitoring wells were gauged four times during 2015 (March 18, July 7, September 15, and December 8). Under non-pumping conditions, groundwater under the Site (on the east side of the river) generally flows to the west toward the river. However, groundwater within the bedrock aquifer flows southwest parallel to a geologic strike. In the subdivisions on the west side of the Shenandoah River, groundwater typically flows to the east and southeast, toward the river. Figures H-2 through H-21 in Appendix H present groundwater elevation contours for the overburden, shallow bedrock, intermediate bedrock and deep

bedrock created using data collected quarterly during 2015, from both during and after consistent operation of the recovery wells.[6]

Results of capture zone analysis presented in the 2015 Annual Report suggest that:

- There is a well-developed cone of depression in the shallow and intermediate bedrock between wells TW-01 and TW-02 and extending across the river.
- The deep bedrock drawdown indicates an elongated cone of depression that extends from TW-02 through TW-01 and across the river to TW-03. However, drawdown values are more variable in this zone, possibly indicating less well-connected fractures.
- The effects of pumping from across the river are evident, and the capture zone created by pumping at TW-03 has now extended to the southeast of TW-03.

See Appendix H for additional information regarding the 2015 CZA.

Groundwater Quality

During the 2015 sampling event, carbon disulfide was the only volatile organic compound (VOC) detected above its OU7 remedial goal of 1,000 micrograms per liter (µg/L). Carbon disulfide was detected in 32 wells and appeared in each of the four flow zones. Detected concentrations exceeded the carbon disulfide remedial goal in five wells (shallow bedrock well MW-03R (located between VB 9 and VB 11), intermediate bedrock wells 205 and 206 (located at the southwest corner of SB-2 and west of the river, respectively), and deep bedrock wells 305 and 336 (located at the southwest corner of SB-2 and west of the river, respectively). This is a decrease from 2014, when carbon disulfide was detected in 34 wells and exceeded the remedial goal in 11 wells. Carbon disulfide concentrations are generally decreasing in wells MW-03R, MW-206 and MW-305, but are increasing in MW-205 and MW-336 (Table H-1 of Appendix H). However, carbon disulfide concentrations in MW-205 remain below historic concentrations. Preliminary results from 2016 suggest further reduction in carbon disulfide concentrations across the Site since pumping began.

Figures H-26 through H-29 in Appendix H show the extent of the carbon disulfide in the overburden, shallow, intermediate and deep bedrock flow zones. Carbon disulfide in the shallow bedrock is limited in extent and centered around MW-03R, located immediately adjacent to the VBs. The lateral extent of carbon disulfide above the remedial goal in the intermediate and deep bedrock units are much larger and extend from the VBs southwest to the western side of the river. However, carbon disulfide was not detected in the Borehole 606 (southwest of TW-03) intermediate groundwater packer interval in a 2013 TW-03 investigation. Furthermore, recovery well TW-03, which began continuous operation after the 2015 sampling event, is located south of MW-206 and is expected to capture contamination in this area. Additional monitoring will determine the effectiveness of groundwater extraction in this area.

During the 2015 sampling event, overburden well MW-09 was the only well to report semi-volatile organic compound (SVOC) detections above the OU7 remedial goals (4-methylphenol and phenol only). SVOCs were not detected above the OU7 remedial goals in the shallow, intermediate or deep groundwater, which is consistent with historical results.

During the 2015 sampling event, concentrations of nine metals (antimony, arsenic, chromium, cobalt, iron, lead, manganese, nickel and vanadium) exceeded their respective OU7 remedial goals in at least one monitoring well. All other metals and cyanide were either not detected or were detected below remedial goals. Although cyanide was not detected in any 2015 sample, the detection limit for cyanide in several samples, including deep bedrock well 305, exceeded the cyanide cleanup goal of 200 µg/L. Deep bedrock well 305 reported cyanide above the cleanup goal during sampling events in 2012, 2013 and 2014. The lack of detectable cyanide at this location in 2015 is likely due to laboratory issues that resulted in an elevated detection limit.

[6] Figures H-2 through H-21 also include groundwater drawdown maps.

Arsenic and antimony are the two most widespread inorganic constituents in groundwater at OU7 and serve as reasonable indicator constituents for delineating the extent of all inorganic constituents. Figures H-26 through H-29 present arsenic and antimony isoconcentration contours from the 2015 sampling event for the four groundwater flow zones.

The two highest arsenic concentrations (3,010 µg/L and 2,480 µg/L) were reported in deep bedrock well 305, located downgradient of the VBs and close to recovery well TW-01, and overburden well MW-09 located immediately downgradient of VB-9. Arsenic concentrations in both wells have been variable over the past four years, but have increased overall since 2012 (Table H-2 in Appendix H).

Intermediate bedrock well 205 and deep bedrock wells 305 and 336 reported the highest concentrations of antimony during the 2015 sampling event. Antimony concentrations in these wells has been variable between 2012 and 2015, but are generally decreasing in well 205 and stable in well 336. Deep bedrock well 305 shows an increase in concentrations between 2012 and 2015, which is also consistent with the trend for arsenic in this well (Table H-3 of Appendix H).

Results from the 2015 sampling event generally show consistent or decreasing concentrations for most other inorganic COCs. An exception is iron and manganese at overburden well MW-10. Iron and manganese concentrations in 2015 are several orders of magnitude higher than recent concentrations measured at MW-10, located downgradient of VB-10. The 2015 Annual Report indicates that the reason for the increase in iron and manganese concentrations is not clear. Turbidity and other field parameters were not significantly different from past results.

VSWMR Compliance Monitoring
Eleven of the 52 sampled wells in the OU7 groundwater monitoring network also serve as VSWMR compliance wells (Figure H-30 in Appendix H). A review of the control charts for the 2015 sampling event, which are included in the 2015 Annual Report, found that most constituents remain below their baseline concentrations, with the exception of a few constituents at MW-09 and WP-10 (See Table H-4 in Appendix H). These constituents were not significantly above their baseline concentrations. Data will continue to be reviewed to establish whether there is a statistically significant pattern indicating increases in the groundwater concentrations.

Surface Water
The objective for the OU7 river monitoring is to collect surface water quality data to determine whether there are decreasing trends in the constituent concentrations found in surface water in the area where the groundwater contamination plume from VB 9-11 is entering the South Fork Shenandoah River. Surface water samples were collected annually, beginning in 2012. Figure H-31 in Appendix H presents the 2015 surface water and co-located sediment sampling locations, except for new sample location SW-8 added in 2015, which is located upstream of the Site.

VOCs, SVOCs and cyanide were not detected in surface water samples collected between 2012 through 2015, except for a low-level qualified detection of carbon disulfide at 1.11 B µg/L in SW-7 in 2013. Table H-6 in Appendix H presents the 2015 surface water sampling results. Refer to the 2015 Annual Report for historical analytical results for OU7 surface water.

Various metals have been detected in surface water samples since sampling began. During the 2015 sampling event, concentrations of metals in river surface water samples were reported as non-detect or at concentrations below the VA DEQ Surface Water Criteria for Public Water Supply (2012) at all sampling locations. This is consistent with historical results.

Sediment
The objective for the OU7 river sediment monitoring is to determine whether there are decreasing trends in the constituent concentrations found in sediment in the area where the groundwater contamination plume from VB 9-

11 is entering the South Fork Shenandoah River. Sediment samples were collected annually, beginning in 2012. Figure H-31 in Appendix H presents the 2015 sediment and co-located surface water sampling locations, except for new location SD-8, located upstream of the Site.

Carbon disulfide and acetone were routinely detected in sediment samples between 2012 and 2015. Carbon disulfide concentrations in all sediment sample locations exceeded the EPA Region 3 freshwater sediment screening benchmark during the 2015 sampling event. However, this is consistent with historical results and does not show an increasing trend. There is no established screening value for acetone. Data will continue to be reviewed to establish whether there is a statistically significant pattern indicating increases in the sediment contamination concentrations. Table H-7 in Appendix H presents a summary of 2015 sediment sampling results. Refer to the 2015 Annual Report for historical analytical results for OU7 sediment.

SVOCs were generally not detected or were detected below the sediment screening benchmarks between 2012 and 2015. The exception is a detection of 4,3-methylphenol above its screening benchmark in SD-8 during the 2015 sampling event. Naphthalene and phenol were also detected at this location, but the concentrations did not exceed the screening benchmarks. Sediment sample location SD-8 is upstream of the Site; therefore, the detected SVOCs are not believed to be related to site activities. SD-8 is also a new sample location added in 2015, so there are no other data available from this location. SD-8 will be included in future monitoring events.

Metals are also routinely detected at all the sediment sampling locations. During the 2015 sampling event, three metals exceeded their screening benchmarks: mercury (SD-04, SD-07, SD-08), manganese (SD-06, SD-08) and iron (SD-08). SD-08, the new upstream location for 2015, reported the most exceedances of screening criteria. The concentrations of metals detected in sediments in 2015 are relatively consistent with results reported from previous years.

Consistent with historic results, total cyanide was not detected in any of the samples in 2015.

Aquatic Biota

Triennial aquatic biota sampling is conducted to determine whether there are decreasing trends in the concentration of PCBs found in the aquatic biota (i.e., fish and macroinvertebrates) that live next to the Site. During the 2015 sampling event, samples were collected at six aquatic biota sampling locations (BMI-1 through BMI-6). Figure H-32 in Appendix H presents the aquatic biota sampling locations. Refer to the 2015 Annual Report for current and historical analytical results for OU7 aquatic biota.

In fish samples, PCBs were detected in multiple samples of smallmouth bass, redbreast sunfish, northern hogsucker, fallfish and comely shiner at concentrations that exceed the VA DEQ Fish Screening Value for PCBs of 0.020 mg/kg. Significant decreases in PCB concentrations have been observed in the smallmouth bass and redbreast sunfish samples since 2012. Comparing the comely shiner results to the previous bluntnose minnow results indicates similar concentrations between 2012 and 2015.

In benthic macroinvertebrate samples, PCBs were detected in only one fingernail clam tissue sample during the 2015 sampling event. Aroclor 1260 was the only Aroclor detected. Although no PCBs were detected in these samples in 2012, the laboratory reporting limits and method detection limits for PCBs during the 2015 event were an order of magnitude lower than those obtained in 2013. There are no tissue screening values for this species.

PCBs were not detected in any of the six sediments samples collected at the aquatic biota sampling stations during the 2015 sampling event.

<u>OU10</u>

Groundwater

The OU10 ROD established soil cleanup goals based on both direct contact and protection of groundwater. The purpose of the groundwater monitoring program for the closed OU10 units (VBs 1-8 and the NLF) is to determine

whether groundwater quality becomes further degraded and, if so, whether an unacceptable risk is posed by the change in water quality conditions. The 2015 sampling event represents the eighth annual monitoring event for OU10. Table H-8 in Appendix H presents the 2015 analytical results. Refer to the 2015 Annual Report for historical results. The groundwater elevation contours for both the overburden and the shallow bedrock for July 2015 are shown on Figures H-33 and H-34 respectively. The groundwater contours for both the overburden and the shallow bedrock are similar to contour maps from previous monitoring events.

VBs 1-8

At VBs 1-8, arsenic, naphthalene, benzene and vinyl chloride concentrations exceeded the applicable EPA RSL in one or more wells during the 2015 sampling event. However, in all but one case, the concentrations were below or within the baseline range for the well. The arsenic concentration at upgradient well 133 exceeded the RSL and was slightly above its baseline concentration.

At downgradient overburden well GPW-14, four constituents (acetone, methyl ethyl ketone, 2-hexanone and xylenes) exceeded their baseline ranges (although detected concentrations were below RSLs). This is the first time these concentrations have been detected above their respective baseline ranges. One detection above the baseline range is not sufficient to determine if an increase in the concentrations has occurred. Continued monitoring is necessary to determine if VBs 1-8 are causing an increase in these VOCs.

At downgradient shallow bedrock well 119, the xylene concentration was above the applicable baseline range (although detected at a concentration below the RSL). The 2015 exceedance was the first exceedance of baseline for xylenes. Continued monitoring will be necessary to determine if an increasing trend is present.

The NLF

At the NLF, the two wells that are representative of upgradient overburden groundwater quality have been sampled, but all downgradient overburden monitoring wells have been dry during each of the monitoring events. Based on the dry conditions at the downgradient monitoring wells, it appears that minimal overburden groundwater is present beneath and downgradient of the NLF.

Carbon disulfide (well 133) and vinyl chloride (well MW-07) were the only VOCs detected in the shallow bedrock monitoring wells downgradient of the NLF during the 2015 sampling event. Both detections exceeded their respective baseline ranges (the vinyl chloride detection also exceeded the RSL). Carbon disulfide has been intermittently detected at well 133, and vinyl chloride has been present in well MW-07 since 2013. Preliminary data from 2016 report similar concentrations of carbon disulfide and vinyl chloride in these wells. There are insufficient data yet to determine if the concentrations of these constituents are increasing or stable.

Concentrations of arsenic, beryllium, and nickel are elevated in the downgradient shallow bedrock wells compared to concentrations in the upgradient shallow bedrock wells; arsenic also exceeded its RSL in MW-07 and well 133. Except for arsenic at well 133, the detected concentrations for these metals were below or within the range of baseline values in their respective wells. Additional monitoring data are required to determine if an increasing trend for arsenic is present at this location.

NTCRA Basins

The purpose of the groundwater monitoring program for the NTCRA-Basin units (that is, the Fly Ash Basins (FABs) and the SBs) is to determine whether groundwater quality becomes further degraded from the viscose and other waste within the units and, if so, whether there is an unacceptable risk posed by the change in water quality conditions. Figures H-35 and H-36 in Appendix H show the NTCRA-Basin monitoring well locations. Sumps for each cover system are also monitored. The 2015 sampling event represents the fifteenth year of annual sampling. Table H-9 in Appendix H presents the 2015 analytical results. Refer to the 2015 Annual Report for historical results.

During the 2015 sampling event, arsenic was the only constituent detected in groundwater at concentrations exceeding the EPA tapwater RSL. This result is consistent with prior sampling events. Overburden well MW-014R reported the highest arsenic concentration in 2015 with a detection of 692 µg/L (compared to the current RSL of 0.052 µg/L and MCL of 10 µg/L). In accordance with the OU7 Groundwater Management Plan (GWMP), the control chart approach was selected as the method to evaluate the data collected in each downgradient well. The control chart for well 014R is presented in the 2015 Annual Report. The control chart shows that the arsenic concentration in groundwater at well MW-014R has remained relatively stable between 2008 and 2015. Control charts for other downgradient wells can be found in the 2015 Annual Report.

Several metals (arsenic, nickel and zinc) and sulfate were detected in samples collected from one or more of the FAB sumps above applicable screening criteria (the more stringent freshwater standards for either aquatic life or human health contained in the Virginia Surface Water Quality Standards). Concentrations have been relatively stable or decreasing in most sumps. Arsenic detected in sump FAB-1-2 increased by two orders of magnitude compared to the 2014 result. Additional data are required to determine if the increase at FAB-1-2 is an anomaly or represents a trend.

Arsenic, copper, nickel and sulfate concentrations exceeded screening criteria in one or more of the SB sumps during the 2015 sampling event. The concentrations of COCs in these sumps has decreased or remained generally stable over the monitoring period.

OU7, OU10 and NTCRA Basin Gas Vents

In accordance with the Sitewide O&M Plan, the PRP performs quarterly monitoring of the passive gas vents associated with OU7, OU10 and the NTCRA Basins. Vents are monitored for methane, VOCs, hydrogen sulfide, lower explosive limit (LEL), carbon monoxide and oxygen. Vents GV-4 and GV-5 at OU10 have vent filter systems (carbon canisters) to treat the vapors from these vents. The PRP monitors the systems for the same parameters as the passive vents, but on a more frequent schedule (twice weekly from May 1 to October 31 and monthly from November 1 to April 31.) The methane, VOC and hydrogen sulfide monitoring results are compared to baseline results, and for methane, to an arbitrary 25 percent LEL to determine if monitoring should continue at the specified frequency. Two-year baseline monitoring was completed in 2015.

During the 2016 monitoring, there were very few detections of hydrogen sulfide significantly above baseline values at the vents, with the exception of vents GV-04 and GV-05. Methane continues to be the most widespread contaminant detected in the vents. The highest concentrations were observed at OU7 and OU10, where a significant number of the methane results exceeded the calculated baseline values. Similar to methane, the highest LEL readings were observed at OU7 and OU10 and the 25 percent LEL was exceeded at most vents in OU7 and OU10 in two of the four quarters in 2016. With the exception of GV-04 and GV-05 at OU10, organic vapors continue to be only sporadically detected at very low levels (below 0.5 parts per million (ppm)) compared to baseline values of 0 to 0.3 ppm.

GV-04 and GW-05 continue to report elevated levels of hydrogen sulfide at the monitoring point before the filter, with concentrations relatively low in the beginning of each year (less than 10 ppm), compared to a baseline of 624.5 ppm for GV-04, and 536 ppm for GV-05, and then typically increasing from April through end of summer (with levels greater than 1,000 ppm by August). Hydrogen sulfide levels at the monitoring point after the filter are lower; however, elevated levels have been observed in GV-04 after the filter during 2016 monitoring. The PRP changes the filter media for the system when elevated levels are observed from the primary filter which discharges to a secondary filter.

The Site's O&M Plan defines the "breathing zone" as an area within three feet of the vent, four to five feet above the ground surface. Throughout the last three years of monitoring, there have been only sporadic detections of hydrogen sulfide in the breathing zone and none of the detections exceeded 1 ppm. In many cases, hydrogen sulfide was not detected in the associated vent and the detections were rarely associated with any odors. Given the lack of odors or pattern to the detections, O&M reports from 2015 and 2016 suggest that those detections may be

related to drift in the instrument and not actual breathing zone results. Methane is detected only sporadically in the breathing zone at relatively low concentrations, well below 25% of the LEL. There were no detections of organic vapors in the breathing zone in 2016. Prior to 2016, detections of organic vapors in the breathing zone occurred only sporadically, and at low concentrations.

Based on the last three years of vent monitoring results, the 2016 sitewide O&M Report recommended the discontinuation of organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. The report also suggested modifying vent sampling frequency at the SBs from quarterly to annually, with exception of a few locations. EPA has reviewed the data associated with the request and agreed with the suggested modification to the vent monitoring at the SBs from quarterly to annually, with exception of a few locations. Additionally, EPA agreed to discontinue the organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. However, if the conditions observed pose a serious imminent threat to human health, the environment, or the remedy, FMC will take immediate action to address the threat and notify EPA as soon as possible of the action being taken.

Site Inspection

The site inspection took place on 6/27/17 and 6/28/2017. In attendance were Jeff Thomas (EPA Region 3 RPM), Frank Avvisato (EPA Headquarters), Charlie Root (EPA Region 3), Sid Curran (EPA oversight contractor Gannett Fleming), Michelle Payne (VA DEQ), Brian McGinnis, Heather Philip and Adam Pugh (PRP contractor Parsons), and Melissa Oakley and Kristin Sprinkle (Skeo). The purpose of the inspection was to assess the protectiveness of the remedy. The site inspection checklist is included in Appendix E. Site inspection photographs are included in Appendix G.

The first day of the Site inspection began with a safety briefing and a tour of the GLTP. Site inspection participants observed the treatment system components, the on-site laboratory, equipment storage room, mechanical room, document storage room, office/control room and the outdoor tank deck area. All treatment system equipment and components were in good condition, operational and clearly labeled. Secondary containment was observed around all tanks and containers. The tank deck is continuously monitored for hydrogen sulfide. Following the GLTP tour, site inspection participants observed VB 9, VB 10, VB 11 and the building that houses the leachate extraction equipment. Two small depressions were observed on the surface of VB 9. The areas have been known to collect water and are void of vegetation. The cap covering the rest of VBs 9-11 appeared to be well-vegetated and in good condition; no burrowing or evidence of erosion were observed.

Site inspection participants observed the former WWTP basins (PB 1, PB 2 and PB 3) and Outfall 004, where the GLTP effluent discharges to the river. The discharge structure was in good condition and operational. “No trespassing” signs were observed at the outfall. The cap covering VB 4, VB 5 and VB 6 appeared to be in good condition. Vegetation is well-established and no evidence of burrowing or erosion was observed. The carbon filtration systems installed at gas vents OU10 GV-4 and OU10 GV-5 were in good condition, operational, secured within tall, locked fence enclosures and clearly labeled.

The PRP contractor uses solar power to power the receiver that receives data transmitted from the extraction well west of the river. The solar panel and receiver appeared to be in good condition and were operational. Site inspection participants then toured the SoccerPlex and former plant side of the Site. Except for the former Avtex administrative building, which now houses the EDA and several small businesses, the plant side of the Site is vacant. Features on the plant side of the Site include gravel roads, scattered concrete and steel rebar, trees and grass. There are no remedial features on the plant side of the Site. A broken water spigot was observed on the western edge of the former plant side of the Site, along the perimeter road. The pressurized water was actively spraying out of a crack in an old metal coupling on the spigot and pooling across the road. The EDA was notified of the leak and they notified the county water department about the issue.

The attendees for the second half of the first day of the Site inspection and the second day of the Site inspection were Jeff Thomas (EPA Region 3 RPM), Sid Curran (EPA oversight contractor Gannett Fleming), and Melissa

Oakley. The second half of the first day of the Site inspection and the second day of the Site inspection were spent walking the Site to perform a thorough inspection of gas vents, monitoring wells, caps, covers, and stormwater management features. Except for a few minor items discussed below, the Site inspection identified no significant issues. In general, the Site is well-maintained; vegetation is well-established on all capped and covered surfaces and no evidence of burrowing or significant erosion or cap settlement was observed.

Access to the GLTP and VBs 9-11 is restricted by a tall fence with locking gates. The main site entrance along Kendrick Lane is fenced and secured with a locked gate outside of normal business hours. All stormwater management features inspected were in good condition. A small woody tree/bush was observed in front of the stormwater discharge pipe for Outfall 002. It was not large enough to significantly impede water flow, but may warrant removal before it grows larger. Small woody trees/bushes were also observed along the northern edge of VBs 4-6. A couple of small areas around the Site are impacted by residual salt from former WWTP operations. The areas appear white and are sparsely vegetated. The salt is not considered an issue and the areas are closely monitored.

Paths were mowed to all gas vents to allow access for gas vent sampling purposes. All gas vents were inspected and found to be operational and clearly labeled. The tall gas vents are bolted to adjacent metal poles that are bolted to the vent pipes to provide support to the vents. In a few instances, the bolts that attach the vent pipes to the support poles had become unthreaded and unattached. It is possible that the slight vibrations caused by the turning of the "whirly-bird" vent caps are causing the bolts to slowly unthread. These unthreaded bolts were observed at vents GV-1, GV-3 and GV-8 (at VBs 4-6), at GV-11 (at VB-1), and at GV-8 (at SB-4). Missing screws associated with the support poles were observed at GV-8 (at SB-1) and GV-2 (at SB-3).

Most monitoring wells inspected were in good condition, secured with locks, and clearly labeled with the following exceptions. Monitoring well GPW-20 was missing its inner well cap, the lock on well GPW-133 was open because the lock was broken and the closure hasp on well MW-06 is corroded.

Following the Site inspection, on August 24, 2017, FMC submitted written and photo documentation showing that it had adequately addressed the minor O&M issues observed during the Site inspection.

Following the focused walking inspection on the second day of the Site inspection, participants drove to the western side of the river and toured the part of the Site along the western bank of the river, along Rivermont Acres Road. The part of the Site west of the river includes several vacant properties owned by the EDA, three permanent residences, a few private properties used temporarily for camper storage, deep groundwater extraction well TW-03, and several monitoring wells. Extraction well TW-03 is secured within a tall, locked fence and appeared to be in good condition. All monitoring wells observed on the west side of the river were secured with locks and clearly labeled. FMC provides residents along Rivermont Acres Road with clean water by filling cisterns with water delivered by truck. The participants briefly talked with Mr. Martin, a resident Rivermont Acres Road. Mr. Martin indicated that he was not aware of any issues related to the Avtex Site.

Prior to the Site inspection, Skeo staff visited the Site's local information repository, Samuels Public Library, located at 330 East Criser Road in Front Royal, Virginia. A records review verified that a large collection of site-related documents, both in disk form and older printed materials, is available for public viewing. Some of the Site's decision documents were not available and none of the FYR reports were available for viewing. EPA will provide the local information repository with updated materials including the addition of this FYR.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

Yes, the review of relevant documents, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the Site inspection indicate that the OU2, OU3, OU4, OU5, OU7, OU8 and OU10 remedies are functioning as intended by site decision documents with one potential exception. The potential exists for a complete ecological exposure pathway associated with OU10 Plant Area Soils due to the lack of redevelopment at the former Plant Area part of the Site. There are no other complete exposure pathways at the Site.

Following Avtex's bankruptcy in 1990, EPA suspended OU1 remediation and later addressed the cleanup under OU7. EPA addressed OU6 (buildings investigation) during the TCRA that addressed site buildings. There is no ROD or selected remedy for OU9. EPA created OU9 as an administrative OU to require the performance of an Ecological Risk Assessment. The Site's 1999 Final Ecological Risk Assessment met the OU9 requirement. Except for the Plant Area Soils (discussed below), the remedies selected by the Site's decision documents addressed the ecological risks identified by the 1999 Final Ecological Risk Assessment.

Implementation of the OU2 remedy by EPA, and later FMC, mitigated potential risks to public health and the environment associated with PCB-contaminated soil, wastes contained in drums, the acid reclaim building and the lack of site security. Demolition of the acid reclaim building and drums also removed obstructions to future site investigations and remediation efforts.

The OU7 remedy addresses groundwater contamination caused by leachate from VBs 9, 10 and 11. Capping of VBs 9, 10 and 11 prevents human and ecological exposure to basin wastes through direct contact and reduces the amount of leachate generated by the basins. The OU7 ROD required institutional controls to maintain and protect the integrity of the remedy and to prevent the installation of drinking water supply wells in the area where groundwater contamination concentrations exceed cleanup goals. Except for some privately owned properties west of the river and the ICIAP, the Site's five UECA Environmental Covenants fulfill the institutional control requirements established for OU7, OU8 and OU10. The covenants run with the land and restrict certain land uses depending on-site area, place restrictions on soil excavation, and prohibit the extraction and use of groundwater and the installation of groundwater wells. The covenants also prohibit activities that could adversely impact the integrity of the remedy. FMC continues to provide water to three residences west of the river, preventing potential exposure to contaminated groundwater via ingestion. The OU7 ROD stated that none of the privately-owned parcels west of the river (in the residential subdivision) have drinking water wells. However, there are no groundwater use restrictions in place for the privately-owned parcels west of the river that overlie the groundwater plume to prohibit the installation of new water supply wells. Installation of new private wells at those privately-owned parcels could potentially affect the direction of plume migration, and potentially result in unacceptable exposures if the water is used for potable purposes. The ICIAP required by the OU7 ROD has not been completed. FMC is in the process of developing the plan and will submit the ICIAP for EPA review.

Implementation of the OU8 remedy required institutional controls to limit land use for Areas B and C to commercial/industrial use in perpetuity. The 2014 UECA Environmental Covenants fulfill the OU8 ROD and 2012 ESD requirements for Areas B and C.

The remedy for the OU10 ROD addressed VBs 1-8, the WWTP, the NLF and Plant Area Soils. The cover systems constructed over the OU10 basins and the NLF prevent direct contact of both human and ecological receptors with impacted soil and wastes, prevent uncontrolled releases of gases from the VBs and NLF, and protect groundwater quality. Excavation of soil with COC concentrations above cleanup goals at the Plant Area Soils and Expanded Plant Area Soils areas mitigated direct contact risks for human receptors in those areas. It is unclear if unacceptable ecological exposures are occurring at the Plant Area Soils part of the Site. That topic is discussed below in the Question B summary.

The TCRAs and NTCRAs completed by EPA and FMC addressed risks to human health and the environment associated with site buildings, sewers and basins not addressed by other site remedial actions. The basin cover systems prevent direct human and ecological exposure to wastes consolidated within the basins, and geomembrane caps installed over some of the basins also prevent infiltration of water through wastes, reducing leachate generation and groundwater impacts. The removal of contaminated site buildings and sewers also

mitigated risks to ecological receptors in the river due to the discharge of PCB-impacted wastewater through the plant's former sewer system.

Based on a review of O&M reports and site inspection observations, the cover systems are well-maintained, as are the associated remedial components, such as the gas vents and stormwater management features. The GLTP and associated infrastructure, such as wells and groundwater and leachate extraction components, are also well-maintained. When routine O&M inspections identify issues, FMC promptly corrects them and documents the process in O&M reports. The 2015 and 2016 topographic surveys of the Site's cover systems reported widespread settlement at the NLF. While the 2016 survey concluded that the NLF cap appears to be settling relatively uniformly and within expected tolerances, continued close monitoring should be performed to confirm that finding. Based on the last three years of vent monitoring results, the 2016 sitewide O&M Report recommended the discontinuation of organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. The report also suggested modifying vent sampling frequency at the SBs from quarterly to annually, with exception of a few locations. EPA has reviewed the data associated with the request and agreed with the suggested modification to the vent sampling frequency at the SBs from quarterly to annually, with the exception of a few locations. Additionally, EPA agreed to discontinue the organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. Due to historically high levels of hydrogen sulfide and other gases, FMC installed carbon filtration units at OU10 GV-4 and OU10 GV-5 in 2014. The units treat vapors from the vents and prevent exposure to hazardous vapors. Hydrogen sulfide levels at the monitoring points after the filters are typically much lower; however, in 2016, elevated levels were observed in OU10 GV-04 after the filter. The PRP changes the filter media for the system when elevated levels are observed; however, more frequent changes or other optimization efforts may be necessary.

FMC regularly monitors groundwater, surface water, sediment and aquatic biotic in accordance with EPA-approved monitoring plans. Sampling results from 2015 indicate that COCs, including key contaminants carbon disulfide, arsenic and antimony, continue to exceed OU7 groundwater remedial goals in overburden and shallow, intermediate and deep bedrock. Groundwater contamination extends from the former VBs south and southwest to the west side of the South Fork Shenandoah River. The OU7 groundwater extraction and treatment system became operational in 2015. Pumping of the three recovery wells is expected to reduce contamination concentrations over time in all groundwater zones downgradient of wells. However, ongoing monitoring is necessary to evaluate the effectiveness of the groundwater extraction and treatment at reducing COCs to remedial goals. The purpose of the groundwater monitoring program for the closed OU10 units (VBs 1-8 and the NLF) is to determine whether groundwater quality becomes further degraded and, if so, whether an unacceptable risk is posed by the change in water quality conditions. Additional OU10 groundwater sampling will determine if constituent concentrations are exhibiting trends that may pose unacceptable risk in the future.

During the 2015 sampling event, detection limits for cyanide in several groundwater samples exceeded the cyanide cleanup goal of 200 µg/L. FMC should work with the analytical laboratory to ensure that it can meet groundwater data quality objectives. Also during the 2015 sampling event, the groundwater sample from overburden well MW-10 reported iron and manganese concentrations several orders of magnitude higher than recent concentrations measured at that location. FMC should continue to monitor this location to determine if the results are an anomaly or if an increasing trend is present.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection still valid?

Question B Summary:

Yes, the cleanup levels and RAOs used at the time of remedy selection are still valid, with one potential exception, OU10 Plant Area Soils, which is discussed below. Although changes to toxicity data have occurred since remedy selection at some OUs, the changes do not call into question the protectiveness of the remedy. Some changes to

exposure assumptions have occurred since the time of remedy selection (e.g., the potential for vapor intrusion from OU7 groundwater and the potential for ecological risk at OU10). The effects of these changes are addressed below.

Appendix I of this FYR evaluates the chemical-specific ARARs identified in Site decision documents to determine if changes in chemical-specific standards affect the protectiveness of the Site's remedy. OU2, OU7 and OU10 were the only OUs where chemical-specific ARARs were identified in decision documents. The evaluation in Appendix I demonstrates that there are no changes to chemical-specific ARARs that affect the protectiveness of the remedies at OU2, OU7 and OU10.

Appendix J of this FYR evaluates the current validity of human health risk-based cleanup standards selected for OU2, OU7 and OU10 using the 2017 EPA RSLs; the RSLs incorporate current toxicity values and standard default exposure factors.

The evaluation demonstrates that the OU2 total PCBs cleanup goal of 10 mg/kg remains valid for commercial/industrial use.

The OU7 ROD selected MCLs and non-zero MCLGs as preliminary remedial goals for groundwater. In the absence of MCLs and non-zero MCLGs, risk-based concentrations were selected as the preliminary remedial goals. The remedial goals were considered preliminary because groundwater which meets the MCLs/MCLGs for individual contaminants may not meet the risk-based standards (1.0E-04 and HI less than or equal to 1) cumulatively if multiple contaminants are present, Therefore the determination of meeting the "protection of human health and the environment" RAO will be performance-based. When preliminary cleanup standards have been attained, EPA will evaluate post-ROD data, from the periodic groundwater monitoring and develop a trend analysis and risk assessment. The risk assessment will be based on an assessment of the cumulative risk across all applicable exposure routes for all COCs remaining in groundwater following achievement of the preliminary cleanup goals. Based on the evaluation in Appendix J, the risk-based preliminary remedial goals for carcinogenic COCs remain valid. Preliminary remedial goals for 12 COCs result in HQs that exceed EPA's benchmark of 1 for noncarcinogens. Although the preliminary remedial goals exceed the noncarcinogenic benchmark, the OU7 ROD states that remediation of groundwater at the Site will continue until the respective MCLs for the COCs are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1×10^{-4}) and the hazard index is reduced to 1 for each specific organ.

The OU7 ROD also identified soil remedial goals for soil located outside the VBs 9, 10 and 11 cover systems. Based on the evaluation in Appendix J, soil remedial goals based on direct contact for carcinogenic COCs remain valid. Soil remedial goals for carbon disulfide and mercury result in HQs that slightly exceed EPA's benchmark of 1 for noncarcinogens. This finding does not affect the protectiveness of the remedy because all soils with concentrations above the standards listed in Table 2 of the 2015 Remedial Action Report were excavated and the areas were either covered with the VB 9-11 cap system or were covered with 2 feet of soil to mitigate the human and ecological pathway. There are no complete exposure pathways for human or ecological receptors for OU7 soil. There was no uncovered area identified that met the original goal, but did not meet the current goal.

The OU10 ROD established soil cleanup goals for PCBs and additional COCs, based on commercial/industrial land use and protection of groundwater. A 2012 risk analysis of all the Plant Area Soils remaining on-site after the completion of the remedial action demonstrated that the soils from zero to 10 feet below ground surface (bgs) are protective of human health for an industrial/commercial scenario and both the surface and the deeper soils are protective of groundwater.

In response to a previous FYR issue, FMC completed a screening-level ecological risk assessment (SLERA) for the former Plant Area Soils part of OU10 in December 2014. The area evaluated included the location of the former manufacturing plant and the surrounding area east of the railroad tracks (about 125 acres). FMC used existing soil data to perform the evaluation; no new sampling was conducted. The SLERA found several chemicals of potential ecological concern present in soil and sediment in the area evaluated at concentrations that exceed ecological risk thresholds, including bioaccumulative contaminants such as mercury and PCBs. However, FMC concluded that the

magnitude and duration of ecological exposures are not expected to produce significant ecological risk due to the presence of relatively low-quality habitat that offers limited foraging, cover or nesting opportunities. As future land use at the Plant Area Soils part of the Site is expected to be developed for commercial/industrial uses, FMC also concluded that such development will eliminate ecological habitat.

EPA reviewed the SLERA and issued a response in August 2015. EPA commented that several aspects of the assessment may need to be further addressed. EPA concluded that while future use of the area is intended to be industrial/commercial, the potential for ecological risk exists if left undeveloped. The ecological risk assessment of the Plant Area Soils part of the Site had previously been delayed due to the promise of redevelopment. However, the area remains vacant and it is unclear when development will occur. In the absence of redevelopment ecological habitat has reestablished on the Former Plant Side, however the quality of this habitat has not been evaluated. EPA also noted that, even with development, it is unknown if such development would effectively mitigate the potential for unacceptable risks to ecological receptors.

The OU10 ESD set soil cleanup goals based on a very conservative residential land use for the Expanded Plant Area Soils. This FYR included review of post-excavation soil results for the Expanded Soils Area included in FMC's Remedial Action Report for the Plant Area Soils Component of Operable Unit 10. Soils remaining on-site after the completion of the remedial action demonstrated that the soils are protective of human health for a residential scenario. The evaluation of the soil cleanup goals in Appendix J demonstrates that the direct contact cleanup goals remain valid for most COCs.

The vapor intrusion pathway was not evaluated in the OU7 human health risk assessment. Because volatile contaminants have been detected in groundwater, this FYR includes a screening level vapor intrusion evaluation using EPA's Vapor Intrusion Screening Level (VISL) calculator to determine the potential for vapor intrusion to indoor air at both the former facility property and downgradient residential properties on the west side of the river.

The only structure on the basin side of the Site is the GLTP. This structure was built on top of a vapor barrier. Therefore, the vapor intrusion pathway is currently incomplete and no further evaluation is necessary for current receptors. To determine if vapor intrusion may be a concern if buildings are constructed in the future without vapor barriers, the well exhibiting the maximum detected concentrations of volatile COCs from overburden groundwater in 2015 (MW-09) was identified, and its sampling data assessed using the VISL calculator. Because institutional controls are in place that prohibit future residential use of the property, a default commercial exposure scenario was evaluated. The screening level evaluation in Appendix J suggests vapor intrusion is not a concern at this time under a commercial use scenario. However, if concentrations increase or anticipated land use changes, the potential for vapor intrusion within the basin property should be re-evaluated.

Although groundwater contamination extends to the west side of the river near residential properties, the potential for vapor intrusion is low. There are no overburden wells currently installed on the west side of the river. However, based on the direction of overburden groundwater flow in this area (east and southeast, toward the river) and the limited extent of VOC contamination in the overburden on the east side of the river, impacts in the overburden on the west side of the river are unlikely. Two shallow bedrock wells installed near the residential properties (162 and 185) on the west side of the river did not report VOCs or SVOCs above method detection limits during the 2015 sampling event. VOCs and SVOCs were detected in the deeper intermediate and deep bedrock zones near the residential properties; however, these zones are overlain by uncontaminated groundwater. The depth of the contamination in the intermediate and deep bedrock zones is also greater than 200 feet bgs and unlikely to be a concern for vapor intrusion, as it is greater than the 100-foot buffer recommended for vapor intrusion evaluations. These results support the conclusion that contaminant vapors are not reaching groundwater near the residential properties at this time. If concentrations in the shallow bedrock zone increase, the potential for vapor intrusion should be re-evaluated.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the

remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OUs for which Protectiveness was not evaluated:
OU1, OU6 and OU9
OUs without Issues/Recommendations Identified in the FYR:
OU2, OU3, OU4, OU5 and OU8

Issues and Recommendations Identified in the FYR:

OU(s): OU7	**Issue Category: Institutional Controls**			
	Issue: The OU7 ROD requires the development of an ICIAP. While FMC is currently developing the ICIAP, it has not yet been completed. Additionally, Site-related groundwater contamination is present beneath the properties west of the South Fork Shenandoah River. However, there are no groundwater use restrictions in place for privately-owned site properties in that area that overlie the groundwater plume.			
	Recommendation: Finalize and implement the ICIAP, as required by the OU7 ROD. Furthermore, implement institutional controls to prevent the installation of water wells at the privately-owned properties west of the river where pumping of water wells could potentially affect plume migration and potentially result in unacceptable human exposure to contaminated groundwater.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	3/26/2019

OU(s): OU10	**Issue Category: Changed Site Conditions**			
	Issue: Due to the delay of the planned site redevelopment, ecological habitat is reestablishing in the Plant Area. The SLERA had found several chemicals of potential ecological concern present in soil and sediment at concentrations that exceed ecological risk thresholds. If the reestablishing habitat allows foraging, cover or nesting opportunities, the potential for unacceptable ecological risks exists for exposure to soil and sediment in the former plant area.			
	Recommendation: Evaluate the current habitat and if needed develop and implement a plan to identify and mitigate unacceptable ecological risks at the former plant area, regardless of anticipated possible future land use.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	3/26/2023

OTHER FINDINGS

In addition, the following recommendations were identified during the FYR. While they may reduce costs and improve management of O&M, they do not affect current and/or future protectiveness:

- *For the OU10 GV-4 and OU10 GV-5 filtration units, develop and incorporate a specific, monitoring result-based trigger for filter replacement into the Site's O&M Plan.*
- *Review all detection limits currently used to analyze groundwater COC concentrations to ensure that all detection limits are as low as, or lower than, COC cleanup goals.*
- *As OU7 groundwater cleanup progresses, consider revisiting the preliminary remediation goals to better align with the final groundwater cleanup goal.*
- *Continue closely monitoring settlement of the NLF cap to ensure that settlement is taking place uniformly and within acceptable tolerances.*
- *Sediment sample location SD-8 is upstream of the Site; therefore, the detected constituents are not believed to be related to site activities. In 2015, 4,3-methylphenol, mercury, iron and manganese concentrations at SD-8 exceeded their respective screening benchmarks. Following additional rounds of future sampling, consider whether the presence of constituents above benchmarks at that upstream location warrants additional consideration as it relates to the evaluation of site-related sediment contamination.*
- *Provide missing decision documents and FYRs to the Site's record repository.*

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement	
Operable Unit: OU2	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU2 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors.	

Protectiveness Statement	
Operable Unit: OU3	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU3 remedy is protective of human health and the environment because the risks previously associated with the unstable acid reclaim building have been addressed via demolition of the building.	

Protectiveness Statement	
Operable Unit: OU4	*Protectiveness Determination:* Protective
Protectiveness Statement: The OU4 remedy is protective of human health and the environment because the risks previously associated with the lack of site security have been addressed.	

Protectiveness Statement	
Operable Unit: OU5	*Protectiveness Determination:* Protective

Protectiveness Statement:
The OU5 remedy is protective of human health and the environment because removal of drummed wastes from the Site eliminated the potential for direct human contact and also mitigated the potential for fire, explosion and releases associated with the wastes.

Protectiveness Statement

Operable Unit: OU7

Protectiveness Determination:
Short-term Protective

Protectiveness Statement:
The remedy at OU7 currently protects human health and the environment in the short term because there are no complete exposure pathways between contaminated groundwater and receptors. Prior impacted residential wells users located across the river are supplied with potable water, institutional controls are in place at the Site and at most downgradient residential properties to prevent installation of new groundwater wells, and the caps over VBs 9, 10 and 11 prevent direct exposure to contaminated soil within the basins. For the remedy to be protective over the long term, the following actions are needed: 1) Implement institutional controls to prevent human exposure to contaminated groundwater and to prevent the installation of water wells at the privately-owned properties west of the river where pumping of water wells could potentially affect plume migration. 2) Finalize and implement the ICIAP, as required by the OU7 ROD.

Protectiveness Statement

Operable Unit: OU8

Protectiveness Determination:
Protective

Protectiveness Statement:
The OU8 remedy is protective of human health and the environment because there are no complete exposure pathways between contaminated soil and receptors. The UECA Environmental Covenant, Instrument 140004561, restricts land use at the areas previously referred to as Areas B and C to commercial/industrial use only.

Protectiveness Statement

Operable Unit: OU10

Protectiveness Determination:
Short-term Protective

Protectiveness Statement:
The remedy at OU10 currently protects human health and the environment in the short term because there are no known complete exposure pathways between contaminated soil and receptors. The cover systems over VBs 1-8 and the NLF prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants from those areas. Excavation of soil contaminated at levels above industrial/commercial cleanup goals at the former Plant Area and the Expanded Plant Area and institutional controls mitigate the risk of direct contact with impacted soil and groundwater at OU10. Ecological habitat is reestablishing due to the delayed redevelopment of the Site. For the remedy to be protective over the long term, the following actions are needed: 1) Evaluate the current habitat and if needed develop and implement a plan to identify and mitigate unacceptable ecological risks at the former Plant Area, regardless of anticipated possible future land use.

Sitewide Protectiveness Statement

Protectiveness Determination:
Short-term Protective

Protectiveness Statement:
Because the remedial actions for all OUs are currently protective, the Site's remedy is currently protective of human health and the environment. There are no known complete exposure pathways between contaminated media and receptors. For the Site remedy to be protective over the long term, the actions listed above for each OU should be implemented.

VIII. NEXT REVIEW

The next FYR Report for the Avtex Fibers, Inc. Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

2013 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. July 8, 2014.

2014 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. February 19, 2016.

2015 Annual Site-Wide Ground Water, Surface Water, and Sediment Monitoring Report for OU-7, OU10, and NTCRA Basins. Avtex Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. June 27, 2017.

Appendix M Site-Wide Groundwater Monitoring Plan, OU-7, OU-10 and NTCRA-Basins, Revision 1. Avtex Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. July 8, 2014. February 3, 2015.

Explanation of Significant Differences, Operable Unit 10, Avtex Superfund Site. U.S. Environmental Protection Agency, Region 3. January 10, 2006.

Final Ecological Risk Assessment, Volume I, Avtex Fibers Site, Front Royal, Virginia. U.S. Environmental Protection Agency, Region 3. February 1999.

Fourth Five-Year Review Report, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. March 26, 2013.

Monitoring Well Repair and Abandonment Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. May 30, 2014.

Operations, Maintenance and Monitoring Manual, Groundwater and Leachate Extraction System, Operable Unit 7, Avtex Fibers Superfund Site. Prepared by Arcadis for FMC Corporation. May 2015.

Operation & Maintenance Manual, Groundwater and Leachate Treatment Plant, Avtex Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. May 2015.

Record of Decision, Operable Unit 1, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 30, 1988.

Record of Decision, Operable Unit 2, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 28, 1990.

Record of Decision, Operable Unit 8 (Areas B and C), Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. September 29, 2000.

Record of Decision, Operable Unit 10, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. March 10, 2004.

Record of Decision, Operable Unit 7, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. January 13, 2010.

Remedial Action Report for the Plant Area Soils Component of Operable Unit 10 for the Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. May 2015.

Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. July 2015.

Remedial Investigation Report for the Proposed SoccerPlex Parcel, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. February 2004.

Review Comments on the Screening Level Ecological Risk Assessment for Plant Area Soils, Avtex Fibers Superfund Site, Front Royal, Virginia. Comments submitted by the U.S. Environmental Protection Agency, Region 3 to FMC Corporation. August 18, 2015.

Screening Level Ecological Risk Assessment for Plant Area Soils, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Environmental Resources Management for FMC Corporation. December 30, 2014.

Second Explanation of Significant Differences, Operable Units 7, 8 and 10, Avtex Superfund Site, Front Royal, Virginia. U.S. Environmental Protection Agency, Region 3. January 25, 2012.

Site-Wide Post-Closure Care Operations and Maintenance (O&M) Plan, Avtex Fibers Superfund Site, Front Royal, Virginia. FMC Corporation. May 2015.

2014 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2015.

2015 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2016.

2016 Site-Wide Operations and Maintenance (O&M) Report, Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. March 2017.

Spring 2016 OU-7 Post-Closure Stormwater Sampling Report for the Avtex Fibers Superfund Site, Front Royal, Virginia. Prepared by Parsons for FMC Corporation. February 14, 2017.

Superfund Preliminary Close-Out Report, Avtex Fibers Superfund Site, Front Royal, Warren County, Virginia. U.S. Environmental Protection Agency, Region 3. August 29, 2014.

Termination of Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants. September 17, 2014.

UECA Environmental Covenants for the Avtex Fibers Superfund Site, Front Royal, Virginia. September 17, 2014.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
American Viscose opened a rayon manufacturing plant at the Site	1940
American Viscose sold the plant and property to FMC	1963
FMC sold the plant and property to Avtex	1976
The Commonwealth of Virginia detected carbon disulfide in domestic water supply wells in the subdivisions across the South Fork Shenandoah River from the Site.	1982
Avtex purchased 23 residential properties west of the river and started providing water to impacted residences in that area	1983-1984
EPA proposed the Site for listing on the NPL	October 15, 1984
An electric transformer exploded on-site, resulting in a release of PCBs	1985
EPA added the Site to the NPL	June 10, 1986
EPA entered a Consent Decree with Avtex to perform an RI/FS to investigate the impacts of the VBs on groundwater	August 11, 1986
Avtex initiated the Site's initial RI/FS	August 13, 1986
EPA amended the Consent Decree to include FMC as a PRP	January 6, 1988
Avtex completed the Site's initial RI/FS	August 27, 1988
EPA issued the OU1 ROD to address groundwater impacts associated with the VBs	September 30, 1988
Sampling conducted by the Virginia State Water Control Board identified PCBs in site soil and in fish tissue samples collected from the Shenandoah River.	1989
Virginia Department of Health issued an advisory against fish consumption in parts of the Shenandoah River, including the South Fork Shenandoah River adjacent to the Site	May 12, 1989
EPA issued a Unilateral Administrative Order to Avtex and FMC to implement the OU1 remedy	June 30, 1989
Virginia Department of Waste Management requested that EPA conduct a removal assessment at the Site	September 20, 1989
EPA issued a Unilateral Administrative Order to Avtex to perform a removal action to address drummed and other site-related waste and site security	October 31, 1989
Virginia Water Control Board revoked Avtex's NPDES permit and Avtex ceased operations on-site	November 10, 1989
EPA initiated the Site's first removal action, which included establishing site security, design and operation of a wastewater treatment system, and management and treatment or disposal of several types of on-site wastes	November 11, 1989
Avtex Fibers, Inc. and Avtex Fibers – Front Royal filed for Chapter XI bankruptcy	February 6, 1990
EPA signed the OU2 ROD. Following signature of the OU2 ROD, EPA redefined site OUs to facilitate project management, site characterization and remedial action. The OU2 ROD established OU2 to address PCB-impacted soil, OU3 to address demolition of the acid reclaim building, OU4 to address site security and OU5 to address drum removal.	September 28, 1990
EPA initiated OU2 (site stabilization and PCB-impacted soil) and OU3 (demolition of the acid reclaim building) remedial action	March 4, 1991
EPA initiated OU4 remedial action (site security)	July 22, 1991
EPA issued a Unilateral Administrative Order to FMC to provide water to residents of the subdivision, west of the river	October 22, 1991
EPA completed OU2 remedial action (cleanup of PCB-impacted soil)	January 22, 1992

Event	Date
EPA and FMC signed a Consent Order that required FMC to complete parts of a sitewide RI (EPA would complete the rest of the RI) Both parties initiated the sitewide RI	March 30, 1993
FMC completed OU5 remedial action (drums)	August 5, 1993
EPA completed the OU3 remedial action	September 23, 1993
FMC and EPA completed the sitewide RI	August 1, 1994
EPA completed OU5 remedial action	September 30, 1994
EPA initiated FS for OU8	June 19, 1995
EPA initiated a TCRA to address site buildings	September 20, 1996
EPA completed the Site's first FYR	November 18, 1996
EPA initiated FS for OU10	June 26, 1997
EPA completed the TCRA to address site buildings	September 1998
EPA completed the Site's Final Ecological Risk Assessment	February 1999
FMC entered into a Consent Decree with EPA to perform additional time-critical removal activities to address site buildings, a NTCRA to address site basins and a NTCRA to address buildings and sewers. The Consent Decree also required that FMC implement the OU7 and OU10 remedies following remedy selection.	July 9, 1999
FMC took over responsibility for site security, control, maintenance and halt and safety measures at the Site, in accordance with the Consent Decree.	October 21, 1999
Avtex Bankruptcy Plan of Reorganization became effective. The Industrial Development Authority of the Town of Front Royal and Warren County, doing business as the Economic Development Authority (EDA) took title to the Site property	November 1999
Stakeholders filed the Conservation Easement to enforce land use restrictions at the Site	December 7, 1999
FMC initiated the OU7 FS	2000
FMC initiated the NTCRA – Buildings and Sewers work	January 2000
EPA signed a removal action memorandum, selecting a NTCRA to address the Site basins (NTRA – Basins)	January 31, 2000
EPA provided the EDA, Town of Front Royal and Warren County with a prospective purchaser agreement and EDA purchased the Site property from the Avtex Bankruptcy Trustee	March 20, 2000
FMC completed the OU8 FS	June 2000
EPA signed the OU8 ROD (institutional controls to restrict land use at Areas B and C to commercial/industrial use)	September 29, 2000
FMC began work to close the on-site basins (NTCRA – Basins)	May 17, 2001
EPA signed a removal action memorandum, selecting NTCRA to address remaining site buildings and sewers (NTCRA – Buildings)	December 2001
FMC completed OU4 remedial action	September 19, 2002
EPA completed the second FYR	March 28, 2003
FMC completed the OU10 FS	July 25, 2003
EPA signed the OU10 ROD (VBs 1-8, the WWTP, the NLF and Plant Area Soils)	March 10, 2004
FMC began OU10 remedial design	May 24, 2004
EPA modified the OU10 remedy in an ESD to expand the Plant Area Soils to include additional areas of concern	January 10, 2006
The Site's first redevelopment project, the Skyline SoccerPlex, opened on-site	September 9, 2006
FMC completed OU10 remedial design and began OU10 remedial action	January 22, 2008
EPA completed the third FYR	March 26, 2008
FMC completed the OU7 FS	July 30, 2009
EPA signed the OU7 ROD (VBs 9-11, groundwater and surface water)	January 13, 2010
FMC started OU7 remedial design	March 15, 2010

Event	Date
FMC completed OU7 remedial design and began OU7 remedial action	October 7, 2011
EPA modified the OU7, OU8 and OU10 remedies with an ESD. The modified remedy replaced the existing Conservation Easement with multiple Environmental Covenants to address multiple property owners and land uses	January 25, 2012
FMC started construction of the OU7 GLTP	July 23, 2012
EPA completed the fourth FYR	March 26, 2013
EPA, VA DEQ and FMC conducted a pre-final construction completion inspection	July 1, 2014
FMC completed remedy construction and EPA issued the Site's Preliminary Close Out Report	August 29, 2014
Site property owners and stakeholders filed five individual UECA Environmental Covenants and a Termination of Conservation and Environmental Protection Easement and Declaration of Restrictive Covenants with the Warren County Clerk's Office	September 17, 2014
FMC completed the Screening Level Ecological Risk Assessment for Plant Area Soils	December 30, 2014
FMC completed the volumes of the Sitewide Post-Closure Care Operations and Maintenance Plans	May 8, 2015
FMC completed the "Remedial Action Report for the Plant Area Soils Component of Operable Unit 10 for the Avtex Fibers Superfund Site"	May 14, 2015
EPA provided FMC with review comments of the 2014 Screening Level Ecological Risk Assessment for Plant Area Soils	August 18, 2015
FMC completed OU10 remedial action; EPA approved FMC's Remedial Action Report for Viscose Basins 1-8, and New Landfill Component of Operable Unit 10; site entered O&M phase	September 1, 2015
FMC completed OU7 remedial action and NTCRA - Basins; EPA approved FMC's Construction Completion Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of OU7, Construction Completion Report Remedial Action Groundwater and Leachate Treatment Plant (GLTP) Component of OU7 and FMC's removal action report and certification of completion for the NTCRA – Basins	September 29, 2015
FMC completed GLTP commissioning activities	December 2015
EPA approved FMC's removal action report and certification of completion for the NTCRA – Buildings	December 30, 2015

APPENDIX C – CLEANUP GOALS FOR OU2, OU7 AND OU10 MEDIA

Table C-1: OU2 Soil Remedial Goal – Total PCBs

COC	Soil Remedial Goal[a] (mg/kg)
PCBs, total	10

Notes:
[a] Soil cleanup goal established by the OU2 ROD.
mg/kg = milligrams per kilogram

Table C-2: OU7 Groundwater Cleanup Goals

COC	ROD Cleanup Goal [a]	
	MCL/non-zero MCLG (µg/L)	Risk-Based Cleanup Goal[b] (µg/L)
Volatile Organics		
acetone		22,000
carbon disulfide		1,000
Semi-volatile Organics		
2-methylphenol (o-cresol)		1,800
4-methylphenol (p-cresol)		180
bis(2-ethylhexyl) phthalate	6	
naphthalene		14
pentachlorophenol	1	
phenol		11,000
Metals		
aluminum		37,000
antimony	6	
arsenic	10	
cadmium	5	
chromium	100	
cobalt		11
cyanide, free	200	
iron		26,000
lead	15	
manganese		880
mercury	2	
nickel		730
vanadium		260
zinc		11,000

Notes:
a. Groundwater cleanup goals are from Table 7 of the OU7 ROD. The OU7 ROD states that the remediation of groundwater at the Site will continue until the respective maximum contaminant levels (MCLs) for the contaminants of concern (COCs) are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1×10^{-4}) and the hazard index is reduced to 1 for each specific organ.
b. EPA Region 3 risk-based tap water standards presented at cancer/hazard target benchmarks of 1×10^{-4} for carcinogens and 1 for noncarcinogens.
µg/L = micrograms per liter
MCLG = maximum contaminant level goal

Table C-3: OU7 Soil Cleanup Goals

COC	Human Health (HH) Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Ecologically Protective Soil Values[a,,e] (mg/kg)	Groundwater Protection Standards[a,d] (mg/L)
Volatile Organic Compounds (VOCs)				
carbon disulfide	378	3,780	NV	1
ethylbenzene	NV	NV	0.05	NV
styrene	NV	NV	0.1	NV
toluene	NV	NV	0.05	NV
xylenes (total)	NV	NV	0.05	NV
Semi-volatile Organic Compounds (SVOCs)				
acenaphthene	NV	NV	20	NV
anthracene	NV	NV	0.1	NV
benzo(a)anthracene	7.8	78	NV	0.000029
benzo(a)pyrene	0.78	7.8	0.1	0.0002
benzo(b)fluoranthene	7.8	78	NV	0.000029
benzo(k)fluoranthene	78.4	784	NV	0.00029
dibenz(a,h)anthracene	0.78	7.8	NV	0.0000029
fluoranthene	NV	NV	0.1	NV
fluorene	NV	NV	30	NV
indeno(1,2,3-cd)pyrene	7.8	78.4	NV	0.000029
naphthalene	18	180	0.1	0.00014
phenanthrene	NV	NV	0.1	NV
pyrene	NV	NV	0.1	NV
PAHs, high molecular weight	NV	NV	11	NV
PAHs, low molecular weight	NV	NV	29	NV
PAHs, total	NV	NV	1.0	NV
Polychlorinated Biphenyls (PCBs)				
PCBs, total	NV	NV	0.371	NV
Metals				
aluminum	NV	NV	20,200[c]	NV
antimony	81.8	818	2.7	0.006
arsenic	3.8	38	18	0.01
barium	NV	NV	330	NV
cadmium	NV	NV	3.6	NV
chromium (as Cr^{+3})	NV	NV	260	NV
cobalt	60	603	13	0.011
copper	8,180	81,800	70	1.3
iron	143,000	1,430,000	31,700[c]	26
Lead[b]	800	800	110	0.015
manganese	NV	NV	441[c]	NV
Mercury (as methyl)	61	613	0.14[c]	0.002
nickel	NV	NV	38	NV
selenium	1,020	10,200	0.52	0.05

COC	Human Health (HH) Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Ecologically Protective Soil Values[a,,e] (mg/kg)	Groundwater Protection Standards[a,d] (mg/L)
silver	NV	NV	42	NV
vanadium	1,030	10,300	78	0.18
zinc	61,300	613,000	233	11
pH	NV	NV	5.5 standard units[e]	NV

Notes:

a. Standards listed in Table 2 of the Site's 2015 OU7 Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7.

b. Per the OU7 ROD, the direct contact standards are based on a total excess cancer risk of 1×10^{-5} and target organ-specific HQ of 1. Direct contact standards are calculated according to procedures detailed in the EPA Risk Assessment Users Guide (May 2010) for potential indoor worker exposure to industrial soil (soil ingestion = 50 mg/day). According to the Users Guide, the indoor worker scenario includes ingestion of soil and inhalation of volatiles/particulate released from soil. The default lead direct contact exposure standard is 800 mg/kg based on typical commercial/industrial exposure. Chromium direct contact exposure standard based on Cr^{+3}.

c. EPA Region 3 Ecologically Protective Backfill Values as listed in Table 11 of the 2010 OU7 ROD, as modified by EPA in the letter to FMC dated March 10, 2010.

d. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

e. The 2012 ESD also added an additional OU7 soil performance standard to address the acidic nature of site soil. The ESD requires that the upper 6 inches of cover soil in remediated areas be amended as needed to achieve a pH of no less than 5.5 prior to seeding/replanting.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

Table C-4: OU10 Soil Cleanup Goals for Direct Contact and Groundwater Protection

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
Volatile Organic Compounds (VOCs)			
1,1,2,2-tetrachloroethane	29	290	0.000053
1,1,1-trichloroethane	57,000	570,000	0.2
1,1,2-trichloroethane	100	1,000	0.003
1,1-dichloroethane	20,000	200,000	0.8
1,1-dichloroethene	10,000	100,000	0.007
1,2-dibromo-3-chloropropane	4.1	41	0.0002
1,2-dibromoethane	0.068	0.68	0.00000075
1,2-dichloroethane	63	630	0.005
1,2-dichlorobenzene	18,000	180,000	0.6
1,2,4-trichlorobenzene	2,000	20,000	0.07
1,3-dichlorobenzene	6,100	61,000	0.18
1,4-dichlorobenzene	240	2,400	0.075
1,2-dichloropropane	84	840	0.005
2-butanone (MEK)	120,000	1,200,000	1.9
2-hexanone	8,200	82,000	1.5
4-methyl-2-pentanone (MIBK)	16,000	160,000	2
acetone	20,000	200,000	0.61
benzene	100	1,000	0.005
bromochloromethane	NV	NV	NV
bromodichloromethane	92	920	0.08
bromoform	720	7,200	0.08
bromomethane	280	2,800	0.0085
carbon disulfide	20,000	200,000	1
carbon tetrachloride	44	440	0.005
chlorobenzene	4,100	41,000	0.1
chloroethane	2,000	20,000	0.0036
chloroform	2,000	20,000	0.08
chloromethane	NV[d]	NV[d]	0.19
cis-1,2-dichloroethene	2,000	20,000	0.07
cis-1,3-dichloropropene[e]	57	570	0.00044
dibromochloromethane	68	680	0.06
ethylbenzene	20,000	200,000	0.7
methylene chloride	760	7,600	0.005
styrene	41,000	410,000	0.1
tetrachloroethene	280	2,800	0.005

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
toluene	41,000	410,000	1
trans-1,2-dichloroethene	4,100	41,000	0.1
trans-1,3-dichloropropene[e]	57	570	0.0004
trichloroethene	14	140	0.005
vinyl chloride	7.9	79	0.002
xylenes (total)	41,000	410,000	10
Semi-volatile Organic Compounds (SVOCs)			
1,2-diphenylhydrazine	7.2	72	0.000084
2,2'-oxybis(1-chloropropane)	NV	NV	NV
2,4,5-trichlorophenol	20,000	200,000	3.7
2,4,6-trichlorophenol	520	5,200	0.0061
2,4-dichlorophenol	610	6,100	0.11
2,4-dimethylphenol	4,100	41,000	0.73
2,4-dinitrophenol	410	4,100	0.073
2,4-dinitrotoluene	410	4,100	0.073
2,6-dinitrotoluene	200	2,000	0.037
2-chloronaphthalene	16,000	160,000	0.49
2-chlorophenol	1,000	10,000	0.03
2-methylnaphthalene	4,100	41,000	0.12
2,4-dichloroaniline	NV	NV	NV
2-nitrophenol	NV	NV	NV
3,3'-dichlorobenzidine	13	130	0.00015
3-nitroaniline[f]	61/286	613/2,860	0.0033
4,6-dinitro-2-methylphenol	20	200	0.0037
4-bromophenyl phenyl ether	NV	NV	
4-chloroaniline	820	8,200	0.15
4-chlorophenyl phenyl ether	NV	NV	
4-nitroaniline	290	2,900	0.0033
4-nitrophenol	1,600	16,000	0.29
acenaphthene	12,000	120,000	0.37
acenaphthylene	NV	NV	
anthracene	61,000	610,000	1.8
benzidine	0.025	0.25	0.00000029
benzo(a)anthracene	7.8	78	0.000092
benzo(a)pyrene	0.78	7.8	0.0002
benzo(b)fluoranthene	7.8	78	0.000092
benzo(g,h,i)perylene	NV	NV	NV
benzo(k)fluoranthene	78	780	0.00092
bis(2-chloroethoxy)methane	NV	NV	NV
bis(2-chloroethyl)ether	5.2	52	0.0000096
bis(2-chloroisopropyl ether)	82	820	0.00026
bis(2-ethylhexyl)phthalate	410	4,100	0.006
butylbenzyl phthalate	41,000	410,000	7.3
carbazole	290	2,900	0.0033

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
p-chloro-m-cresol	NV	NV	NV
chrysene	780	7,800	0.0092
di-n-butylphthalate	20,000	200,000	3.7
di-n-octyl phthalate	4,100	41,000	0.73
dibenzo(a,h)anthracene	0.78	7.8	0.0000092
dibenzofuran	400	4,000	0.012
diethylphthalate	160,000	1,600,000	29
dimethyl phthalate	2,000,000	20,000,000	370
fluoranthene	8,200	82,000	1.5
fluorene	8,200	82,000	0.24
hexachlorobenzene	3.6	36	0.001
hexachlorobutadiene[f]	40.9/73.4	409/734	0.00086
hexachlorocyclopentadiene	1,200	12,000	0.05
hexachloroethane[f]	204/409	2,044/4,088	0.0048
indeno(1,2,3-cd)pyrene	7.8	78	0.000092
isophorone	6,000	60,000	0.07
n-nitrosodiphenylamine	1,200	12,000	0.014
n-nitrosodipropylamine	0.82	8	0.0000096
naphthalene	4,100	41,000	0.0065
nitrobenzene	100	1,000	0.0035
p-chloro-m-cresol	NV	NV	NV
p-(dimethylamino)azobenzene	NV	NV	NV
pentachlorobenzene	160	1,600	0.029
pentachlorophenol	48	480	0.001
phenanthrene	NV	NV	NV
o-cresol/2-methylphenol	10,000	100,000	1.8
p-cresol/4-methylphenol	1,000	10,000	0.18
phenol	61,000	610,000	11
pyrene	6,100	61,000	0.18
Metals			
aluminum	200,00	2,000,000	37
antimony	82	820	0.006
arsenic	3.8	38	0.01
barium	14,000	140,000	2
beryllium	410	4,100	0.004
cadmium	200	2,000	0.005
calcium	NV	NV	NV
chromium	610	6,100	0.1
cobalt	4,100	41,000	0.73
copper	8,200	82,000	1.3
iron	61,000	610,000	11
lead	1,000[g]	1,000[g]	0.015
magnesium	NV	NV	NV
manganese	4,100	41,000	0.73

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
mercury[h]	20	200	0.002
nickel	4,100	41,000	0.73
potassium	NV	NV	NV
selenium	1,000	10,000	0.05
silver	1,000	10,000	0.18
sodium	NV	NV	NV
thallium	14.4	144	0.0005
vanadium	1,400	14,000	0.26
zinc	61,000	610,000	11
cyanide, free	4,100	41,000	0.2
Polychlorinated Biphenyls (PCBs)			
Arochlor 1016	14.3/81.8[f,i]	NA[i]	0.0005
Arochlor 1221	2.9[i]	NA[i]	0.0005
Arochlor 1232	2.9[i]	NA[i]	0.0005
Arochlor 1242	2.9[i]	NA[i]	0.0005
Arochlor 1248	2.9[i]	NA[i]	0.0005
Arochlor 1254	2.9[i]	NA[i]	0.0005
Arochlor 1260	2.9[i]	NA[i]	0.0005
Total PCBs	NA	25[j]	0.0005

Notes:

a. Standards as presented in Table 1 of the Site's 2004 OU10 ROD. The OU10 ROD established soil cleanup standards for direct contact (soils 0 to 10 feet) and groundwater protection (entire depth of soil to the water table).

b. The direct contact cleanup goals based on 1×10^{-5} risk level for carcinogens and a HQ of 1 for non-carcinogens are applicable if it can be demonstrated that there are no more than 10 carcinogens present in excess of the 1×10^{-6} risk level, and that none of the noncarcinogens exceeding an HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the 1×10^{-6} risk level, the direct contact cleanup goals will be the levels identified for a 1×10^{-6} excess cancer risk. The cumulative risks for noncarcinogens that have the same target organ must not exceed a HQ of 1; therefore, the direct contact cleanup goals for noncarcinogens having the same target organ will be the levels identified for a HQ of 0.1. The direct contact standards are calculated according to procedures utilized in the EPA Region 3 Risk-based Concentration Table (April 25, 2003 version with June 17, 2003 update) for industrial soil, except an indoor worker exposure scenario (soil ingestion = 50 mg/day) was used instead of the outdoor worker exposure (soil ingestion = 100 mg/day). The default lead direct contact exposure standard is 1,000 mg/kg based on typical commercial/industrial exposure. Chromium direct contact exposure based on Cr^{+6}.

c. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)

into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

d. EPA Region 3 removed the direct contact standard for chloromethane in the April 2003 update of the RBCs.

e. 1,3-Dichloropropene standard used.

f. 3-Nitroaniline, hexachloroethane, hexachlorobutadiene and Arochlor 1016 are listed as carcinogens; however, the noncarcinogenic standards at an HQ=0.1 and an HQ=1.0 are less than the carcinogenic standards at 1×10^{-6} and 1×10^{-5}, respectively. Both carcinogenic and noncarcinogenic standards are shown.

g. The soil cleanup level for lead of 1,000 mg/kg is the only value used and is irrespective of the HQ.

h. Methylmercury direct contact standard used as default standard for mercury.

i. The 1×10^{-6} Arochlor-specific direct contact cleanup standards for PCBs will only be used to determine if there are more than 10 carcinogens present that exceed the 1×10^{-6} risk level direct contact cleanup standards. If more than 10 carcinogens exceed 1×10^{-6} risk level standards, then the non-PCB carcinogens will be compared to their respective 1×10^{-6} risk level direct contact cleanup standards and the total PCB concentration will be compared to the 25 mg/kg direct contact cleanup standard. If 10 or fewer carcinogens are present that exceed the 1×10^{-6} risk level direct contact cleanup standards, the non-PCB carcinogens will be compared to their respective 1×10^{-5} risk level direct contact standards and the total PCB concentration will be compared to the 25 mg/kg direct contact cleanup standard. A soil direct contact cleanup standard for the 1×10^{-5} cancer risk level in not applicable (NA) for PCBs for use at OU10.

j. The OU10 direct contact soil cleanup standard for total PCBs is 25 mg/kg. This cleanup standard is risk-based and consistent with the substantive standards of 40 CFR, § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups, EPA determined that the risk-based cleanup approach found in 40 CFR, § 761.61(c) is relevant and appropriate to this cleanup, and that the 25 mg/kg total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990, page 27, Table 3-1.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

Table C-5: OU10 Expanded Plant Area Soils - Soil Cleanup Standards for Direct Contact and Groundwater Protection

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
Volatile Organic Compounds (VOCs)			
1,1,2,2-tetrachloroethane	3.2	32	0.000053
1,1,1-trichloroethane	2,200	22,000	0.2
1,1,2-trichloroethane	1.1	11	0.003
1,1-dichloroethane	1,600	16,000	0.8
1,1-dichloroethene	390	3,900	0.007
1,2-dibromo-3-chloropropane	0.46	4.6	0.0002
1,2-dibromoethane	0.32	3.2	0.00000075
1,2-dichloroethane	7	70	0.005
1,2-dichlorobenzene	700	7,000	0.6
1,2,4-trichlorobenzene	78	780	0.07
1,3-dichlorobenzene	23	230	0.18
1,4-dichlorobenzene	27	270	0.075
1,2-dichloropropane	9.4	94	0.005
2-butanone (MEK)	4,700	47,000	1.9
2-hexanone	313	3,130	1.5
4-methyl-2-pentanone (MIBK)	NV	NV	NV
acetone	7,000	70,000	0.61
benzene	12	120	0.005
bromochloromethane	NV	NV	NV
bromodichloromethane	10	100	0.08
bromoform	81	810	0.08
bromomethane	11	110	0.0085
carbon disulfide	780	7,800	1
carbon tetrachloride	4.9	49	0.005
chlorobenzene	160	1,600	0.1
chloroethane	220	2,200	0.0036
chloroform	78	780	0.08
chloromethane	NV[d]	NV[d]	0.19
cis-1,2-dichloroethene	78.2	782	0.07
cis-1,3-dichloropropene[e]	6.4	64	0.00044
dibromochloromethane	7.6	76	0.06
ethylbenzene	780	7,800	0.7
methylene chloride	85	850	0.005
styrene	1,600	16,000	0.1
tetrachloroethene	1.2	12	0.005
toluene	630	6,300	1
trans-1,2-dichloroethene	160	1,600	0.1
trans-1,3-dichloropropene[e]	6.4	64	0.0004

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
trichloroethene	1.6	16	0.005
vinyl chloride	0.09	0.9	0.002
xylenes (total)	1,600	16,000	10
Semi-volatile Organic Compounds (SVOCs)			
1,2-diphenylhydrazine	0.8	8.0	0.000084
2,2'oxybis(1-chloropropane)	NV	NV	NV
2,4,5-trichlorophenol	780	7,800	3.7
2,4,6-trichlorophenol	58	580	0.0061
2,4-dichlorophenol	23	230	0.11
2,4-dimethylphenol	160	1,600	0.73
2,4-dinitrophenol	16	160	0.073
2,4-dinitrotoluene	16	160	0.073
2,6-dinitrotoluene	7.8	78	0.037
2-chloronaphthalene	630	6,300	0.49
2-chlorophenol	39	390	0.03
2-methylnaphthalene	31	310	0.12
2-nitroaniline	NV	NV	NV
2-nitrophenol	NV	NV	NV
3,3'-dichlorobenzidine	1.4	14	0.00015
3-nitroaniline	2.3	23	0.0033
4,6-dinitro-2-methylphenol	0.78	7.8	0.0037
4-bromophenyl phenyl ether	NV	NV	NV
4-chloroaniline	31	310	0.15
4-chlorophenyl phenyl ether	NV	NV	NV
4-nitroaniline[f]	23.5/32	235/320	0.0033
4-nitrophenol	62.6	626	0.29
acenaphthene	470	4,700	0.37
acenaphthylene	NV	NV	NV
anthracene	2,300	23,000	1.8
benzidine	0.0028	0.028	0.00000029
benzo(a)anthracene	0.87	8.7	0.000092
benzo(a)pyrene	0.087	0.97	0.0002
benzo(b)fluoranthene	0.87	8.7	0.000092
benzo(g,h,i)perylene	NV	NV	NV
benzo(k)fluoranthene	8.7	87	0.00092
bis(2-chloroethoxy)methane	NV	NV	NV
bis(2-chloroethyl)ether	0.58	5.8	0.0000096
bis(2-chloroisopropyl ether)	9.1	91	0.00026
bis(2-ethylhexyl)phthalate	46	460	0.006
butylbenzyl phthalate	340	3,400	7.3
carbazole	32	320	0.0033
p-chloro-m-cresol	NV	NV	NV
chrysene	87	870	0.0092
di-n-butylphthalate	780	7,800	3.7

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
di-n-octylphthalate	313	3,130	0.73
dibenz(a,h)anthracene	0.087	0.87	0.0000092
dibenzofuran	15.6	156	0.012
diethyl phthalate	6,300	63,000	29
dimethyl phthalate	78,200	782,000	370
fluoranthene	310	3,100	1.5
fluorene	310	3,100	0.24
hexachlorobenzene	0.4	4.0	0.001
hexachlorobutadiene[f]	1.56/8.2	15.6/82	0.00086
hexachlorocyclopentadiene	47	470	0.05
hexachloroethane[f]	7.8/46	78/460	0.0048
indeno(1,2,3-cd)pyrene	0.87	8.7	0.000092
isophorone	670	6,700	0.07
n-nitrosodiphenylamine	130	1,300	0.014
n-nitrosodipropylamine	0.091	0.91	0.0000096
naphthalene	160	1,600	0.0065
nitrobenzene	3.9	39	0.0035
p-chloro-m-cresol	NV	NV	NV
p-(dimethylamino)azobenzene	NV	NV	NV
pentachlorobenzene	6.3	63	0.029
pentachlorophenol	2.5	25	0.001
phenanthrene	NV	NV	NV
o-cresol/2-methylphenol	390	3,900	1.8
p-cresol/4-methylphenol	39	390	0.18
phenol	2,300	23,000	11
pyrene	230	2,300	0.18
Metals			
aluminum	7,820	78,200	37
antimony	3.1	31	0.006
arsenic	15.9[g]	15.9[g]	0.01
barium	1,600	16,000	2
beryllium	16	160	0.004
cadmium	7.8	78	0.005
calcium	NV	NV	NV
chromium	233[g]	233[g]	0.1
cobalt	156	1,560	0.73
copper	310	3,100	1.3
iron	2,300	23,000	11
lead	400[h]	400[h]	0.015
magnesium	NV	NV	NV
manganese	2,272[g]	2,272[g]	0.73
mercury[i]	0.78	7.8	0.002
nickel	160	1,600	0.73
potassium	NV	NV	NV

COC	HH Direct Contact Standard[a,b] (1×10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1×10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)
selenium	39	290	0.05
silver	39	390	0.18
sodium	NV	NV	NV
thallium	0.55	5.5	0.0005
vanadium	184[g]	184[g]	0.26
zinc	2,300	23,000	11
cyanide, free	1,600	16,000	0.2
Polychlorinated Biphenyls (PCBs)			
Arochlor 1016	5.5/9.12[j]	NA[j]	0.0005
Arochlor 1221	0.32[j]	NA[j]	0.0005
Arochlor 1232	0.32[j]	NA[j]	0.0005
Arochlor 1242	0.32[j]	NA[j]	0.0005
Arochlor 1248	0.32[j]	NA[j]	0.0005
Arochlor 1254	0.32[j]	NA[j]	0.0005
Arochlor 1260	0.32[j]	NA[j]	0.0005
PCBs, total	NA	1[k]	0.0005

Notes:

a. Standards as presented in Table 1A of the Site's 2006 OU10 ESD. To facilitate future recreational use of the Expanded Plant Area Soils area, EPA selected risk-based soil cleanup goals based on future residential use.

b. The direct contact cleanup goals based on 1×10^{-5} risk level for carcinogens and a HQ of 1 for non-carcinogens are applicable if it can be demonstrated that there are no more than 10 carcinogens present in excess of the 1×10^{-6} risk level, and that none of the noncarcinogens exceeding an HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the 1×10^{-6} risk level, the direct contact cleanup goals will be the levels identified for a 1×10^{-6} excess cancer risk. The cumulative risks for noncarcinogens that have the same target organ must not exceed a HQ of 1; therefore, the direct contact cleanup goals for noncarcinogens having the same target organ will be the levels identified for a HQ of 0.1. The direct contact standards are calculated according to procedures utilized in the EPA Region 3 Risk-based Concentration Table (October 25, 2005 version) for residential soil. The default lead direct contact exposure standard is 400 mg/kg based on typical residential exposure. Chromium direct contact exposure based on Cr^{+6}.

c. The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. If neither a non-zero MCLG or MCL have been established for a compound, the groundwater protection standard is based on the EPA Region 3 risk-based concentrations (RBCs) for tap water. To determine compliance with the groundwater protection soil standards, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the groundwater protection soil standard.

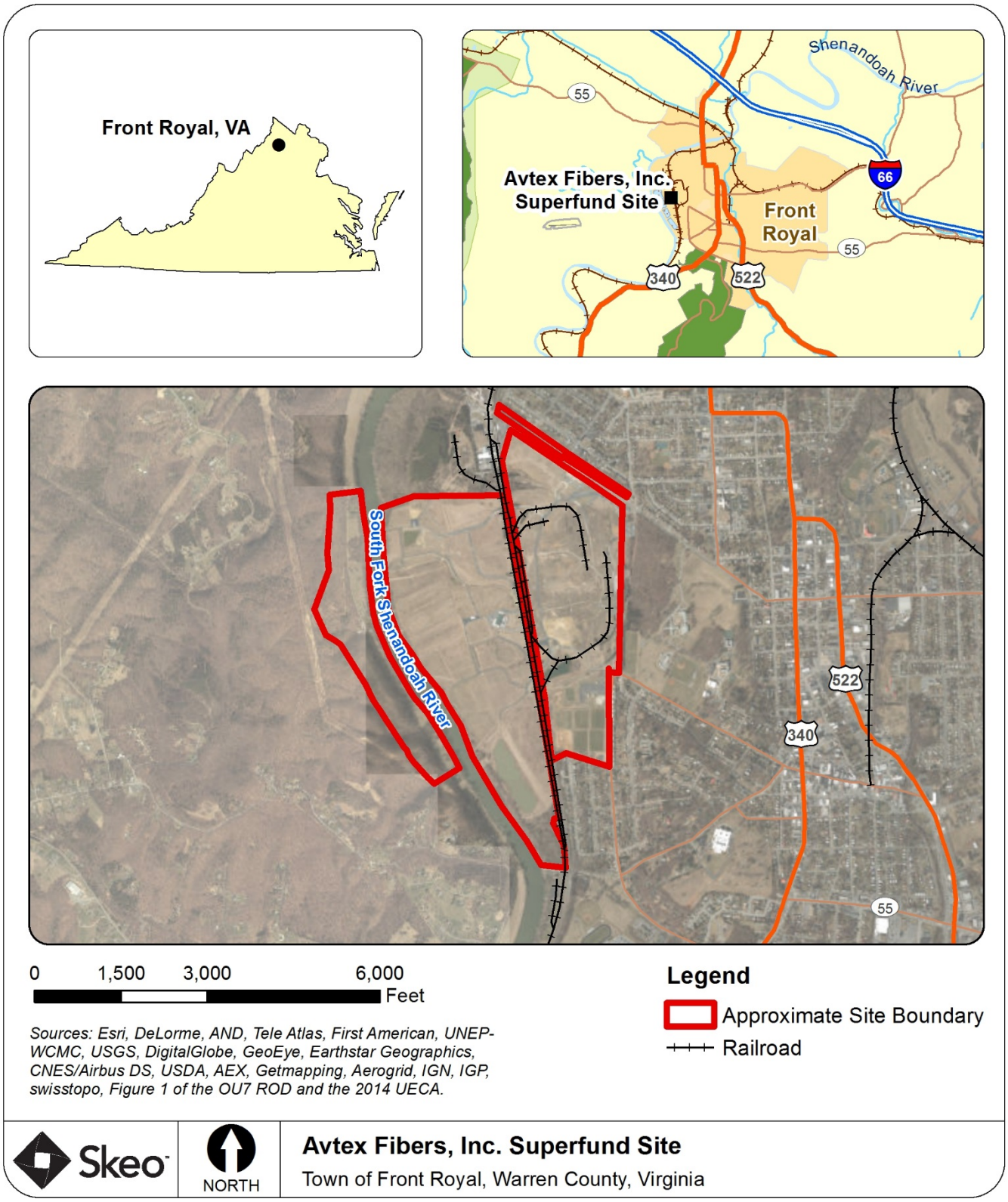
COC	HH Direct Contact Standard[a,b] (1 x 10^{-6} Risk and HQ=0.1) (mg/kg)	HH Direct Contact Standard[a,b] (1 x 10^{-5} Risk and HQ=1) (mg/kg)	Groundwater Protection Standards[a,c] (mg/L)

d. EPA Region 3 removed the direct contact standard for chloromethane in the April 2003 update of the RBCs.
e. 1,3-Dichloropropene standard used.
f. 4-Nitroaniline, hexachloroethane and hexachlorobutadiene are listed as carcinogens; however, the noncarcinogenic standards at an HQ=0.1 and an HQ=1.0 are less than the carcinogenic standards at 1 x 10^{-6} and 1 x 10^{-5}, respectively. Both carcinogenic and noncarcinogenic standards are shown.
g. Upper Tolerance Limit calculated from the Virginia data in Boerngen and Shacklette (1981).
h. The soil cleanup level for lead of 400 mg/kg is the only value used and is irrespective of the HQ.
i. Methylmercury direct contact standard used as default standard for mercury.
j. The 1 x 10^{-6} Arochlor-specific direct contact cleanup standards for PCBs will only be used to determine if there are more than 10 carcinogens present that exceed the 1 x 10^{-6} risk level direct contact cleanup standards. If more than 10 carcinogens exceed 1 x 10^{-6} risk level direct contact cleanup standards, then the non-PCB carcinogens will be compared to their respective 1 x 10^{-6} risk level direct contact cleanup standards and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. If 10 or fewer carcinogens are present that exceed the 1 x 10^{-6} risk level direct contact cleanup standards, the non-PCB carcinogens will be compared to their respective 1 x 10^{-5} risk level direct contact standards and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. A soil direct contact cleanup standard for the 1 x 10^{-5} cancer risk level is not applicable (NA) for PCBs for use at OU10.
k. The OU-10 direct contact soil cleanup standard for total PCBs is 1 mg/kg. This cleanup standard is risk-based and consistent with the substantive standards of 40 CFR, § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups, EPA determined that the risk-based cleanup approach found in 40 CFR, § 761.61(c) is relevant and appropriate to this cleanup, and that the 1 mg/kg total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990, page 27, Table 3-1.

HQ = Hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NV = no value available

APPENDIX D – SITE MAP

Figure D-1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

APPENDIX E – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Avtex Fibers, Inc.	**Date of Inspection: 6/27/2017 and 6/28/2017**
Location and Region: Front Royal, Virginia 3	**EPA ID: VAD070358684**
Agency, Office or Company Leading the Five-Year Review: EPA Region 3	**Weather/Temperature: Sunny and 70 degrees**

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Leachate extraction and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** _____ Name _____ Title _____ Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems, suggestions ☐ Report attached:

2. **O&M Staff** _____ Name _____ Title _____ Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency VADEQ

Contact	Name	Title	Date	Phone No.
	Michelle Payne	RPM	2/23/18	804-698-4014

   Problems/suggestions ☒ Report attached: _____

4. **Other Interviews** (EDA) ☒ Report attached:

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: The Site has three O&M manuals, one sitewide plan, one plan for the GLTP and one plan for the VB leachate extraction system. All O&M plans, as-built drawings and maintenance logs are maintained electronically. Hard copies are also maintained on-site in the GLTP office/control room.

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A

   ☒ Contingency plan/emergency response plan ☒ Readily available ☐ Up to date ☐ N/A

Remarks: The site-specific health and safety plan and emergency response plan are maintained electronically. Hard copies are also maintained on-site in the GLTP office/control room.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: All training records are maintained electronically. Hard copies of training records are also maintained on-site in the GLTP office/control room.

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☒ Other permits: The NLF operates under a state-issued landfill permit.	☒ Readily available	☒ Up to date	☐ N/A

Remarks: The GLTP discharges effluent to the South Fork Shenandoah River in accordance with a NPDES permit.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☐ N/A

Remarks: The O&M Plan requires an annual land surface topographic survey of the cover systems for at least two years following construction completion. The annual topographic survey is to be compared to the baseline topographic survey (i.e., the "as built" survey conducted at construction completion) to assess whether settlement has occurred on any of the units. Prior topographic data will be compared to subsequent topographic data to identify areas of settlement. This comparison is used in lieu of settlement monuments. The most recent survey did not identify any areas of significant settlement.

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: FMC submits annual groundwater monitoring reports.

8. **Leachate Extraction Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: FMC documents leachate and groundwater extraction in quarterly and annual O&M reports.

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks: FMC documents effluent discharge compliance records in quarterly and annual O&M reports.

10. **Daily Access/Security Logs** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: All visitors to the GLTP are required to sign in upon entry into the facility.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house	☐ Contractor for state
☐ PRP in-house	☒ Contractor for PRP
☐ Federal facility in-house	☐ Contractor for Federal facility

☒ FMC has contracted Parsons to manage site-related O&M activities.

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☐ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: The OU7 ROD estimated annual OU7 O&M costs of $1,230,000. O&M activities associated with OU7 remedial components began at the end of 2015. The costs below include utilities. No other O&M cost information was submitted for review as part of this FYR.

Total annual cost by year for review period if available

Year: 2015 Total cost: $2,439,388

Year: 2016 Total cost: $2,440,000

Year: 2017 Total cost: $2,030,627

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: The actual annual O&M costs are significantly higher than the original annual cost estimate presented in the ROD. However, it should be noted that the costs presented above also include utilities. The annual costs seem relatively consistent from year-to-year and are more accurate than the original estimate. In the future, significant changes in annual O&M costs will be investigated to determine if the fluctuations in cost are related to potential O&M issues.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: All fencing appeared to be in good condition.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: "No trespassing" signs are posted along the Site perimeter, at outfalls along the river and on the GLTP fence. Gates remain locked outside of normal business hours.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: FMC and the EDA (for EDA-owned properties)

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☒ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

Please see response below.

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: The OU7 ROD requires institutional controls that prevent the installation of drinking water supply wells in the area where the groundwater contamination exceeds cleanup goals. Groundwater use restrictions are not in place for the privately owned properties located above the plume, west of the river. The OU7 ROD also requires the creation of an ICIAP. That plan has not yet been created.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: No trespassing or vandalism has taken place within the GLTP fence. Trespassers sometimes gain access to the Site from the boat landing, the river or the railroad tracks that bisect the Site. Since the previous FYR, people would trespass in the former pump house structure along the eastern bank of the river, within the Site. In response, the PRP contractor secured the doors and windows with boards and cut down the trees near the building used to gain access to the inside of the building. The trespassers do not tamper with any of the remedial components. FMC has posted "no trespassing" signs throughout the Site and works with local law enforcement authorities to address trespassing when it occurs.

2. **Land Use Changes On Site** ☐ N/A

Remarks: Since the previous FYR, FMC completed construction of the new GLTP and associated infrastructure. On the former plant side of the Site, earth-moving efforts have begun as part of the new IT Federal development gets underway. IT Federal plans to build a large data management center at the Site as part of the larger Royal Phoenix development. The plan for Warren County to construct a new police department on the far eastern part of the Site (east of Kendrick Lane) has been approved. The Town of Front Royal broke ground on the police department project in December 2017.

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: All site roads are in good condition.

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☐ Settlement not evident

Arial extent: _____ Depth: _____

Remarks: With the exception of two small low spots areas observed on the cover of VB-9, no areas of settlement were observed. FMC is aware of the two low areas on VB-9 and will fill in the areas if needed. Several of the "crook-neck" passive gas vents are slightly tilted, indicating minor cap settlement across several of the capped site areas. However, the gas vents remain completely functional and the minor settlement is not considered an issue at this time.

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

Lengths: _____ Widths: _____ Depths: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Arial extent: _____ Depth: _____

Remarks: No significant erosion was observed on the NLF or on the covers of any of the Site basins. A few small bare areas were noted for future monitoring, but they are not considered an issue.

4. **Holes** ☐ Location shown on site map ☒ Holes not evident

Arial extent: _____ Depth: _____

Remarks: _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established

☒ No signs of stress ☐ Trees/shrubs (indicate size and locations on a diagram)

Remarks: In general, the vegetative grass cover over the Site is well-established and appears healthy. Only a few small areas were identified where vegetation is sparse: a bare spot on SB-3 near GV-8 and a few small salt-impacted areas throughout the Site. These small bare spots are noted in the quarterly O&M reports and closely monitored. Efforts are taken to re-establish vegetation at those areas as needed.

6. **Alternative Cover** (e.g., armored rock, concrete) ☒ N/A

Remarks: _____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident

Arial extent: _____ Height: _____

Remarks: _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Arial extent: _____
☐ Ponding	☐ Location shown on site map	Arial extent: _____
☐ Seeps	☐ Location shown on site map	Arial extent: _____
☐ Soft subgrade	☐ Location shown on site map	Arial extent: _____

Remarks: _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map

☒ No evidence of slope instability

Arial extent: _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

C. Letdown Channels ☒ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ No evidence of settlement
   Arial extent: _____ Depth: _____
   Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation
   Material type:_____ Arial extent: _____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ No evidence of erosion
   Arial extent: _____ Depth: _____
   Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting
   Arial extent: _____ Depth: _____
   Remarks: _____

5. **Obstructions** Type: _____ ☒ No obstructions
   ☐ Location shown on site map Arial extent: _____
   Size: _____
   Remarks: _____

6. **Excessive Vegetative Growth** Type: _____
   ☒ No evidence of excessive growth
   ☒ Vegetation in channels does not obstruct flow
   ☐ Location shown on site map Arial extent: _____
   Remarks:

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
   ☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
   ☐ Evidence of leakage at penetration ☒ Needs maintenance ☐ N/A
   Remarks: The tall gas vents are bolted to adjacent metal poles that are bolted to the vent pipes to provide support to the vents. In a few instances, the bolts that attach the vent pipes to the support poles have become unthreaded, unattached. It is possible that the slight vibrations caused by the turning of the "whirly-bird" vent caps are causing the bolts to slowly unthread. These unthreaded bolts were observed at vents GV-1, GV-3 and GV-8 (at VBs 4-6), at GV-11 (at VB-1) and at GV-8 (at SB-4). Missing screws associated with the support poles were observed at GV-8 (at SB-1) and GV-2 (at SB-3). Following the Site inspection, FMC corrected the above-mentioned O&M issues and submitted written and photo documentation of the repairs to EPA. All gas vents were inspected and found to be operational and clearly labeled.

2. **Gas Monitoring Probes**
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: Monitoring wells are located outside of the basin covers.

4. **Extraction Wells Leachate**

☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A

Remarks: _____

E. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☒ Good condition ☐ Needs maintenance

Remarks: Only two of the gas vents – GV-4 and GV-5 – are equipped with carbon filtrations systems. The filtration was deemed necessary due to the high concentrations of hydrogen sulfide and other gases emitted from those two wells. The vents and filtration units are secured within locked fenced enclosures.

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: Not applicable.

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: Not applicable.

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☐ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☐ Erosion not evident

Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: A small woody tree/bush was observed in front of the stormwater discharge pipe for Outfall 002. It was not large enough to significantly impede water flow. FMC removed the vegetation following the Site inspection and submitted documentation of the action to EPA.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☒ Functioning ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☒ Good condition ☒ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☒ Metals removal ☐ Oil/water separation ☒ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☒ Filters: Multi-media filtration, granulated activated carbon (GAC) adsorption and post-GAC bag filtration

☐ Additive (e.g., chelation agent, flocculent): _____

☒ Others: Solids thickening and dewatering

☒ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: The GLTP was constructed in 2014 and started full-scale operation in mid-2015. The system is relatively new and in good condition.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☒ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☒ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Monitoring well GPW-20 is missing its inner well cap, well GPW-133 may need a new lock and the closure hasp on well MW-06 is severely rusted. Following the Site inspection, FMC corrected these minor O&M issues and submitted written and photo documentation of the repairs to EPA. All other monitoring wells inspected were secured with locks and clearly labeled.

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the Site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The site inspection indicates that the OU2, OU7, OU8 and OU10 remedies are functioning as intended by site decision documents. There are no complete exposure pathways at the Site. Implementation of the OU2 remedy mitigated potential risks to public health and the environment associated PCB-contaminated soil, with wastes contained in drums, the acid reclaim building and the lack of site security. The long-term remedy for OU7 includes installation of low-permeability caps over VB-9, VB-10 and VB-11; construction and operation of a groundwater and leachate extraction and treatment system; characterization and remediation of soil and sediment outside of the VB 9-11 cap system, including sediment associated with seeps adjacent to VB 9-11, and OU-7 soils outside of the VB 9-11 cap system; institutional controls; and long-term monitoring and maintenance. FMC provides water to three affected residences along the west bank of the river. The Town of Front Royal provides potable water to areas east

	of the river via a public water supply system. Institutional controls are in place at the Site and at most downgradient residential properties to prevent installation of new groundwater wells, and the caps over VBs 9, 10 and 11 prevent direct exposure to contaminated soil within the basins. However, groundwater use restrictions are not in place for the privately owned properties west of the river. UECA Environmental Covenant, Instrument 140004561 restricts land use at the areas previously referred to as Areas B and C (OU8) to commercial/industrial use only. Regarding OU10, the cover systems over VBs 1-8 and the NLF prevent direct human and ecological receptor contact with VBs 1-8 and NLF soil and waste and prevent the migration of contaminants from those areas. Excavation of soil contaminated at levels above cleanup goals at the plant area and expanded plant area, and institutional controls mitigate the risk of direct contact with impacted soil and groundwater at OU10. However, following a review of the 2014 Plant Area Soils SLERA, EPA concluded that the potential for unacceptable ecological risk exists.
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. No significant O&M issues have been identified that could potentially impact the current protectiveness of the remedy. The previous FYR recommended the development and implementation of a comprehensive groundwater monitoring well evaluation plan. In response to that FYR recommendation, Environmental Resources Management prepared the 2014 Monitoring Well Repair and Abandonment Report to document the well abandonments and repairs on behalf of FMC.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. FMC is requesting permission from EPA to curtail pumping of extraction well TW-03 in order to optimize the remedy and reduce costs. The PRP is also considering alternative methods to extract additional leachate from the basins. Based on the last three years of vent monitoring results, the 2016 sitewide O&M Report recommended the discontinuation of organic vapor monitoring and of breathing zone reading monitoring at all basin areas except OU10 GV-4 and OU10 GV-5. The report also suggested modifying vent sampling frequency at the SBs from quarterly to annually, with exception of a few locations. Consider if these O&M modifications are acceptable, and if so, update the O&M Manual accordingly.

APPENDIX F – INSTITUTIONAL CONTROLS

Figure F-1: Example UECA Environmental Covenant: Instrument 140004561 – Plant Side

WARREN COUNTY, VIRGINIA
LAND RECORDS

000133 SEP 17 2014

Tax Map Nos.: 20A1-3-6A, 20A1-3-7C, 20A1-3-7A and 20A1-3-7

Remediation Program Site ID #: VAD070358684

UECA ENVIRONMENTAL COVENANT

This environmental covenant is made and entered into as of the 17th day of September, 2014, by and between the Industrial Development Authority of the Town of Front Royal and the County of Warren, Virginia, trading as the Economic Development Authority (EDA), successor to Avtex Fibers-Front Royal, Inc. (Avtex), to be indexed as Grantor, whose address is 400 Kendrick Lane, Front Royal, Virginia 22630 (Grantor or Owner), and FMC Corporation (FMC), to be indexed as Grantee, whose address is 1735 Market Street, Philadelphia, Pennsylvania 19103, and Clean Water Project, Inc., to be indexed as Grantee, whose address is 6799-A Kennedy Road, Warrenton, Virginia 20187 (hereinafter referred to as the Grantees or Holders).

The United States is named as a third-party beneficiary of the covenants, conditions and restrictions set forth below for the purpose of enforcing these covenants, conditions and restrictions.

This environmental covenant is executed pursuant to the Virginia Uniform Environmental Covenants Act, § 10.1-1238 *et seq.* of the Code of Virginia (UECA), and the U.S. Environmental Protection Agency (EPA) shall be the "Agency" as defined therein. This environmental covenant subjects the Property identified in Paragraph 1 to the activity and use limitations in this document.

1. Property Affected.

The property affected (Property) by this environmental covenant is located on or adjacent to Kendrick Lane, Front Royal, Virginia 22630, and is a part of the same real estate conveyed unto the EDA from Avtex by Deed dated March 27, 2000, as Instrument No. 000001681, among the land records of Warren County, Virginia. The Property is more particularly described in Exhibit A (Avtex Fibers Superfund Site—Metes and Bounds Descriptions of Areas 2, 2A and 2B).

The Property is part of the Avtex Fibers Superfund Site (the Avtex Site). The Avtex Site is approximately 496.7 acres in size and is depicted as Areas 1, 2, 2A, 2B, 3, 4, 5 and 6 in the map attached hereto as Exhibit B. Grantor owns Areas 2, 2A, 2B, 3 and 4, but does not own Areas 1, 5 and 6.

This environmental covenant pertains only to Areas 2 and Parcels 2A and 2B as described in Exhibit A (Metes and Bounds Descriptions of Areas 2, 2A and 2B) attached hereto and as depicted in the map attached hereto as Exhibit B.

Activity and use limitations pertaining to Areas 1, 3, 4, 5 and 6 and depicted in the map attached hereto as Exhibit B shall be addressed under other legal instruments.

2. Description of Contamination & Remedy.

a. Pursuant to Section 105 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, (CERCLA), 42 U.S.C. § 9605, EPA placed the Avtex Site on

1

the National Priorities List, set forth in 40 C.F.R. Part 300, Appendix B, on June 10, 1986. EPA has been involved in selecting and implementing a number of removal and remedial actions (also known as "environmental response projects" as that term is defined at Section 10.1-1238 of UECA) under CERCLA at the Avtex Site from at least 1988. EPA's selection of removal actions are embodied in Action Memoranda, and EPA's selection of remedial actions are embodied in Records of Decision (RODs). EPA selected the remedial action in phases, or Operable Units (OUs) as they are known under CERCLA, at the Avtex Site by issuing a number of OU RODs. Portions of the OU RODs were modified by two Explanations of Significant Differences (ESDs) and a Memorandum to the Administrative Record File documenting a minor modification to the remedial actions (Minor Modification Memorandum). Copies of all of the Action Memoranda, OU RODs, ESDs and the Minor Modification Memorandum for the Avtex Site are available online at: http://www.epa.gov/reg3hwmd/npl/VAD070358684.htm. FMC has been involved in implementing certain of those removal and remedial actions at the Avtex Site from 1986.

b. The administrative records pertaining to the environmental response projects described in the Action Memoranda, the RODs, the ESDs and the Minor Modification Memorandum are located at the locations listed below:

US EPA Region III, Sixth Floor Docket Room
1650 Arch Street, 6th Floor
Philadelphia, Pennsylvania 19103
(215) 814-3024

Samuels Public Library
538 Villa Avenue
Front Royal, VA 22630
(540) 635-3153.

The administrative records are also available online at:
http://loggerhead.epa.gov/arweb/public/search_results.jsp?siteid=VAD070358684.

c. The United States and FMC executed a Consent Decree in *United States v. FMC Corporation*, Civil Action No. 5:99CV00054 (W.D. Va. 1999), which was entered by the United States District Court for the Western District of Virginia on October 21, 1999, and which requires FMC to finance and perform certain removal and remedial actions at the Avtex Site. A copy of the Consent Decree is available online at: http://www.epa.gov/reg3hwmd/npl/VAD070358684.htm.

3. Activity & Use Limitations.

The Property is subject to the following activity and use limitations, which shall run with the land and are binding on Grantor and any successors, assigns, tenants, agents, employees, and any other persons under its control, until such time as this environmental covenant may terminate or be amended as provided by law:

a. The Property shall be restricted to light commercial and industrial use. By way of example only and not of limitation, the following types of uses are permitted on the Property: colleges and other institutions of higher education without on-premises residences; business, professional and government offices and facilities, including

telecommuting stations, call centers and data storage centers; theaters; light manufacturing facilities; retail shops and stores that do not cater primarily to children; eating establishments; grocery stores; customer service businesses such as banks other financial institutions, accountants, insurance agencies, dry cleaners and laundries; personal service facilities such as barber shops, beauty shops, fitness centers, gyms, tattoo parlors, and tanning salons; warehouses and distribution facilities; parking facilities; public safety facilities such as fire, rescue and police stations; recycling transfer stations and material processing; public transportation facilities; repair service establishments; contractors' and tradesmen's offices and facilities; dental and medical offices and clinics, including but not limited to optometrists, chiropractors, hearing specialists, and similar specialists, and health care supply retailers; research and development facilities.

b. The following activities and uses are prohibited on the Property:

1. Child or day care centers;
2. Pre-school, elementary, middle or high schools;
3. Residential dwellings of any kind;
4. Outdoor recreational facilities;
5. Elder care facilities;
6. Facilities that shelter or house animals;
7. Hunting or trapping of animals;
8. Facilities that cater to or are specifically designed for children under the age of 12;
9. Accumulation of trash, refuse, junk or any other unsightly material;
10. Hotels, motels, hospitals, bed and breakfasts, or any other overnight accommodations.

c. Excavation of soils on the Property.

1. Except as provided in Paragraph 3.c.2 immediately below, excavation of soil 10 feet below the elevations depicted on the map attached hereto as Exhibit C is prohibited;
2. Excavation of soil in any manner is prohibited in Borrow Area A depicted on the map attached hereto as Exhibit C.

d. Until such time as EPA determines that the groundwater clean-up levels specified in the OU7 ROD have been achieved and this environmental covenant has been amended to allow the same, the following groundwater use and well restrictions shall apply:

1. Groundwater beneath the Property shall not be extracted or used for any purpose, except as may be required by EPA or DEQ for ground water monitoring and/or remediation; and
2. No groundwater extraction wells shall be installed on the Property, until and unless, approved, in writing, by EPA.

e. The Property shall not be used in any manner that would interfere with, adversely affect or impair the integrity, protectiveness or efficacy of the removal or remedial actions implemented or to be implemented pursuant to the Consent Decree. The Property

shall only be used in a manner which is consistent with any obligations or restrictions that EPA determine are necessary to implement, ensure non-interference with or ensure protectiveness of the removal or remedial actions implemented or to be implemented pursuant to the Consent Decree.

4. The United States as Third-Party Beneficiary. The United States is expressly granted the power to enforce the covenants, conditions, and restrictions set forth in Paragraph 3 above. This environmental covenant may not be terminated or modified without the express written consent of the United States, nor may a Holder be removed or replaced without the express written consent of the United States.

5. Compliance and Use Reporting.

a. Beginning on October 28, 2017, and every five years thereafter, or whenever else requested in writing by EPA, the then current owner of the Property shall submit, to EPA and all Holders, written documentation stating whether or not the activity and use limitations in this environmental covenant are being observed. This documentation shall be signed by a qualified official of the then current owner who has inspected and investigated compliance with this environmental covenant.

b. In addition, within one month after any of the following events, the then current owner of the Property shall submit, to the United States, EPA, the Virginia Department of Environmental Quality (DEQ) and the Holders, written documentation describing the following: noncompliance with the activity and use limitations in this environmental covenant; transfer of the Property; changes in use of the Property; or filing of applications for building permits for the Property and any proposals for any Avtex Site work, if such building or proposed Avtex Site work will affect the contamination on the Property subject to this environmental covenant.

6. Access by the Holders, EPA and DEQ.

In addition to any other rights granted to the Holders, EPA and DEQ, this environmental covenant grants to the Holders, EPA and DEQ an irrevocable, permanent and continuing right of access at all reasonable times to the Property for the purposes of:

a. Performing or implementing any activity relating to the removal or remedial actions required by the Consent Decree or otherwise required by EPA or DEQ;

b. Verifying any data or information submitted to EPA or DEQ;

c. Verifying or monitoring that no action is being taken on the Property in violation of the terms of this environmental covenant or any federal or state environmental laws or regulations;

d. Monitoring removal or remedial actions on the Avtex Site and conducting investigations related to contamination on or near the Avtex Site, including, but not limited to, sampling of air, water, sediments and soils;

e. Conducting periodic reviews of any removal or remedial actions, including but not limited to, reviews required by federal or state environmental laws or regulations;

f. Implementing additional or new removal or remedial actions if EPA, in its sole discretion, determines that such actions are necessary to protect human health and/or the environment; and

g. Enforcing or monitoring compliance with the terms, conditions and restrictions of this environmental covenant as set forth in Paragraph 9 below.

7. No Limitation.

Nothing in this environmental covenant shall limit or otherwise affect EPA's rights of entry and access or EPA's authority to take removal or remedial actions under CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan, or other federal law.

8. Notice Requirement.

The Grantor shall notify the United States, EPA, DEQ and the Holders in writing sixty days prior to closing on any proposed conveyance of any interest in any portion of the Property. Grantor shall include in any instrument conveying any interest in any portion of the Property, including but not limited to deeds, leases, and mortgages, a notice which is in substantially the following form:

NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____, 2014, RECORDED IN THE CLERK'S OFFICE OF THE CIRCUIT COURT OF WARREN COUNTY ON _____, 2014, INSTRUMENT NUMBER _____, IN FAVOR OF, AND ENFORCEABLE BY FMC CORPORATION, CLEAN WATER PROJECT, INC., THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND THE UNITED STATES AND THEIR SUCCESSORS AND ASSIGNS.

Within 30 days of the date any such instrument of conveyance is recorded, Grantor shall provide the United States, EPA, DEQ and the Holders with a file-stamped copy of said instrument with a copy of the recording receipt attached.

9. Enforcement.

The United States, on behalf of EPA, and the Holders shall be entitled to enforce the terms of this environmental covenant by resort to specific performance or legal process. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA. Enforcement of the terms of this instrument shall be at the discretion of the United States and the Holders, and any forbearance, delay or omission to exercise their rights under this environmental covenant in the event of a breach of any term of this instrument shall not be deemed a waiver by the United States or the Holders of such term or of any subsequent breach of the same or any other term, or of any of the rights of the United States, EPA or the Holders under this instrument.

10. Notices.

Any notice, demand, request, consent, approval, or communication that any party desires or is required to give to the others shall be in writing and shall either be served personally or sent by certified mail, return receipt requested, addressed as follows:

To the United States:

Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044

To EPA:

Chief, Remediation Branch No. 3 (3RC43)
Office of Regional Counsel
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

EPA Project Coordinator (3HS23)
Office of Superfund Site Remediation
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

To FMC:

Avtex Site Project Coordinator
FMC Corporation
1735 Market Street
19th Floor
Philadelphia, PA 19103

General Counsel
FMC Corporation
1735 Market Street
19th Floor
Philadelphia, PA 19103

To Grantor:

Executive Director
Economic Development Authority
400-D Kendrick Lane
Front Royal, VA 22630

To Clean Water Project, Inc.

President
Clean Water Project, Inc.
6799-A Kennedy Road
Warrenton, Virginia 20187

To Virginia Department of Environmental Quality

Office of Remediation Program
Virginia Department of Environmental Quality
629 East Main Street
Richmond, Virginia 65241.

11. Prior Liens and Encumbrances.

Based on a title search conducted by the Grantor on the Property prior to execution of this environmental covenant, the Grantor represents that there are no encumbrances or liens on the Property to which this environmental covenant would be subordinate except those expressly listed in Exhibit D hereto. Any other liens or encumbrances recorded on the Property will be subordinate to this environmental covenant.

12. Recording, Proof and Notification.

a. In accordance with 9VAC 15-90-40(B)(1), the Grantor shall submit to DEQ a copy of this environmental covenant and the accompanying fee required to be paid pursuant to 9VAC 15-90-40 prior to recording or causing this environmental covenant to be recorded, as required by Paragraph 12.b of this environmental covenant, immediately below.

b. Within 90 days after the date of execution of this environmental covenant, the Grantor shall record, or cause to be recorded, this environmental covenant with the Clerk of the Circuit Court of Warren County. The Grantor shall likewise record, or cause to be recorded, any amendment, assignment, or termination of this environmental covenant with the Clerk of the Circuit Court of Warren County within 90 days of their execution. Any UECA environmental covenant, amendment, assignment, or termination recorded outside of these periods shall be invalid and of no force and effect.

c. The Grantor shall send a file-stamped copy of this environmental covenant, and of any amendment, assignment, or termination, to the Holders, the United States, EPA and DEQ with a copy of the recording receipt attached within 60 days of recording. Within that time period, the Grantor also shall send a file-stamped copy to the chief administrative officer of Warren County,

any persons who are in possession of the Property who are not the Grantors, and any other parties to whom notice is required pursuant to UECA.

13. Liberal Construction.

This instrument shall be liberally construed in favor of the rights, covenants, conditions, and restrictions granted in this environmental covenant. If any provision of this environmental covenant is found to be ambiguous, an interpretation consistent with the purpose of this instrument that would render the provision valid shall be favored over any interpretation that would render it invalid.

14. Severability.

If any provision of this instrument, or the application of it to any person or circumstance, is found to be invalid, the remainder of the provisions of this environmental covenant, or the application of such provisions to persons or circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

15. Termination or Amendment.

This environmental covenant is perpetual and runs with the land unless terminated or amended (including assignment) in accordance with UECA.

16. Enforcement of Environmental Covenant.

This environmental covenant shall be enforced in accordance with § 10.1-1247 of the Code of Virginia.

17. Successors and Assigns.

a. The rights and obligations stated herein shall inure to and be binding on the successors and permitted assigns of the parties to this environmental covenant.

b. FMC shall have the right to assign its rights and obligations under this environmental covenant to a new holder formed by FMC to be known as FMC Corporation, as follows:

1. Any such assignment is subject to the prior written consent of EPA and DEQ.

2. Grantor and Clean Water Project, Inc. hereby consent to any such assignment and waive any further right they may have to consider and consent to it at a later date.

ACKNOWLEDGMENTS:

GRANTOR

Industrial Development Authority of the Town of Front Royal and the County of Warren, Virginia, trading as the Economic Development Authority

By: Patricia S Wines

Patricia S. Wines
Chairman, Board of Directors
Industrial Development Authority of the Town of Front Royal and County of Warren, Virginia
400-D Kendrick Lane
Front Royal, Virginia 22630

Attest:

Jennifer R. McDonald
Executive Director

COMMONWEALTH OF VIRGINIA

COUNTY OF WARREN

On this 5th day of September, 2014, before me, the undersigned officer, personally appeared Patricia S. Wines, Chairman, and Jennifer R. McDonald, Executive Director, on behalf of the Industrial Development Authority, who acknowledged themselves to be the persons whose names are subscribed to this environmental covenant, and acknowledged that they freely executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

My commission expires: 8-31-2015

Registration #: 7507269

Notary Public

AMBER R. MARICLE
NOTARY PUBLIC 7507269
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES 08-31-2015

WARREN COUNTY, VIRGINIA
LAND RECORDS

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HOLDERS

FMC CORPORATION

By: Barry J. Crawford

Name: Barry J. Crawford

Title: Vice President, Operations

Address: 1735 Market Street
Philadelphia, PA 19103

COMMONWEALTH OF PENNSYLVANIA

CITY/COUNTY OF Philadelphia

On this 8th day of September, 2014, before me, the undersigned officer, personally appeared BARRY J. CRAWFORD who acknowledged himself/herself to be the person whose name is subscribed to this environmental covenant, and acknowledged that s/he freely executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

My commission expires: March 29, 2016

Registration #:

Mary Ellen DiVito

Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MARY ELLEN DiVITO, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 29, 2016

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CLEAN WATER PROJECT, INC.

By: _____

Joseph T. Ivers
President
6799-A Kennedy Road
Warrenton, Virginia 20187

COMMONWEALTH OF VIRGINIA

CITY/COUNTY OF Fauquier

On this 5th day of September, 2014, before me, the undersigned officer, personally appeared Joseph T. Ivers, who acknowledged himself to be the person whose name is subscribed to this environmental covenant, and acknowledged that he freely executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

My commission expires: 3/31/2016

Registration #: 265560

Betty Marie Norton

Notary Public

BETTY MARIE NORTON
NOTARY PUBLIC
REG # 265560
MY COMMISSION EXPIRES
3/31/2016
COMMONWEALTH OF VIRGINIA

LAND RECORDS

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

APPROVED by the United States Environmental Protection Agency as required by § 10.1-1238 et seq. of the Code of Virginia.

By: _____
Cecil A. Rodrigues, Director
Hazardous Site Cleanup Division
United States Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

COMMONWEALTH OF PENNSYLVANIA

CITY/COUNTY OF Philadelphia

On this 12 day of September, 2014, before me, the undersigned officer, personally appeared Cecil A. Rodrigues who acknowledged himself to be the person whose name is subscribed to this environmental covenant, and acknowledged that he freely executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

My commission expires: December 17, 2016

Registration #: _____

Bettina L. Dunn

Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
BETTINA L. DUNN, Notary Public
City of Philadelphia, Phila. County
My Commission Expires December 17, 2016

SEEN AND RECEIVED by the Virginia Department of Environmental Quality.

By: Durwood H Willis

Durwood H. Willis, Director
Office of Remediation Programs
Department of Environmental Quality
629 E. Main Street
Richmond, Virginia 23218

COMMONWEALTH OF VIRGINIA

CITY OF RICHMOND

On this 15 day of September, 2014, before me, the undersigned officer, personally appeared Durwood H. Willis who acknowledged himself to be the person whose name is subscribed to this environmental covenant, and acknowledged that he freely executed the same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

My commission expires: February 28, 2018

Registration #: 207528

Notary Public

BENEFICIARY

THE UNITED STATES OF AMERICA

SAM HIRSCH
Acting Assistant Attorney General
U.S. Department of Justice
Environment and Natural Resources Div.

By: James A. Lofton
JAMES A. LOFTON
Counsel to the Chief
U.S. Department of Justice
Environment and Natural Resources Div.
Environmental Enforcement Section
P.O. Box 7611
Washington, D.C. 20044

VERIFICATION

STATE OF KANSAS)
) *SS*.
COUNTY OF JOHNSON)

BE IT REMEMBERED, THAT ON THIS 11th day of September, 2014, before me, the undersigned Notary Public in and for the County and State aforesaid, came James A. Lofton, who is personally known to me to be the same person who executed the above and foregoing instrument and duly acknowledged the execution of the same as his free act and deed.

IN WITNESS WHEREOF, I have hereunto subscribed by name and affixed my notarial seal on the day and year last above written.

Kent [signature]
Notary Public

My appointment Expires: 7/23/15

7/23/15

EXHIBIT A

AVTEX FIBERS SUPERFUND SITE—METES AND BOUNDS DESCRIPTIONS OF AREAS 2, 2A AND 2B

METES AND BOUNDS DESCRIPTION OF AREA 2

Beginning at an iron rod found in the southerly right of way line of Virginia Secondary Route 620 (Kendrick Lane) at the northwesterly corner of the Town of Front Royal, Virginia land; thence with the westerly line of the Town of Front Royal, Virginia land, the Potomac Edison Company of Virginia land, and the Trustees of the Randolph Macon Academy land, S 01° 27' 20" W – 2,920.15 feet to an iron rod found in the northerly right of way line of West Main Street; thence with the northerly right of way line of West Main Street for the two following courses: N 60° 55' 52" W – 3.44 feet to an iron rod found; thence N 88° 32' 16" W – 196.82 feet to an iron pipe found at the intersection with the westerly right of way line of Kerfoot Avenue and in the line of Tax Parcel 20A1-3-5A; thence with the line of Tax Parcel 20A1-3-5A for the three following courses: N 01° 27' 44" E – 42.75 feet to an iron rod found; thence S 71° 27' 18" W – 1,001.29 feet to an iron rod found; thence S 42° 54' 31" W – 250.81 feet to an iron rod found in the easterly right of way line of the Norfolk & Southern Railroad; thence with the easterly right of way line of the Norfolk & Southern Railroad, N 09° 54' 31" W – 3,291.36 feet to a point at the southerly corner of Area 2B; thence with the easterly line of Area 2B for the two following courses: N 80° 00' 07" E – 410.72 feet to a point; thence N 34° 42' 20" E – 683.23 feet to an iron rod found at the southwesterly corner of Tax Parcel 20A1-3-6A; thence with Tax Parcel 20A1-3-6A for the two following courses: S 55° 17' 40" E – 646.65 feet to an iron rod found; thence N 01° 27' 27" E – 298.93 feet to a point in the southerly right of way line of Kendrick Lane; thence with the southerly right of way line of Kendrick Lane, S 55° 17' 40" E – 762.20 feet to the point of beginning. LESS AND EXCEPTING therefrom a conveyance from Industrial Development Authority of the Town of Front Royal and the County of Warren, Virginia, trading as the Economic Development Authority to the County of Warren, Virginia, by deed dated July 9, 2013, which was recorded in the Clerk's Office of the Circuit Court of Warren County, Virginia, as Instrument Number 130004736.

Containing . . . . . 121.9987 Acres, More or Less

METES AND BOUNDS DESCRIPTION OF AREA 2A

Beginning at an iron rod found in the northerly right of way line of Virginia Secondary Route 620 (Kendrick Lane) and at the intersection with the easterly right of way line of Adams Avenue; thence with the easterly right of way line of Adams Avenue, N 19° 11' 50" E – 170.18 feet to an iron rod found in the southerly line of the Royal Village Subdivision; thence with the southerly line of the lots of the Royal Village Subdivision, S 55° 17' 40" E – 2,739.75 feet to an iron pipe found at a point in the westerly right of way line of Massanutten Avenue; thence S 34° 42' 20' W – 160.00 feet to an iron rod found in the northerly right of way line of Kendrick Lane; thence with the northerly right of way line of Kendrick Lane for the two following courses: N 55° 17' 40" W – 2,616.68 feet to an iron rod found; thence with the arc of a curve to the left 77.70 feet (Radius = 756.20 feet) to the point of beginning. LESS AND EXCEPTING therefrom a conveyance from Industrial Development Authority of the Town of Front Royal and the County of Warren, Virginia, trading as the Economic Development Authority to the County of Warren, Virginia to the Town of Front Royal, Virginia, by deed dated May 30, 2014, which was recorded in the Clerk's Office of the Circuit Court of Warren County, Virginia, as Instrument Number 1140002746.

Containing . . . . . 4.7443 Acres, More or Less

METES AND BOUNDS DESCRIPTION OF AREA 2B

Beginning at an iron rod found at the northeasterly corner of the Norfolk & Western Railroad Company land and in the southerly right of way line of Virginia Secondary Route 620 (Kendrick Lane); thence with the southerly right of way line of Kendrick Lane, S 55° 17' 40" E – 1,139.73 feet to an iron rod found at the northwesterly corner of Tax Parcel 20A1-3-6A; thence with the westerly line of Tax Parcel 20A1-3-6A for the two following courses: with the arc of a curve to the left 54.978 feet (Radius = 35.00 feet) to an iron rod found; thence S 34° 42' 20" W – 215.00 feet to an iron rod found at the southwesterly corner of Tax Parcel 20A1-3-6A; thence with a new line along Area 2 for the two following courses: S 34° 42' 20" W – 683.23 feet to a point; thence S 80° 00' 07" W – 410.72 feet to a point in the easterly right of way line of the Norfolk & Southern Railroad right of way; thence with the easterly right of way line of the Norfolk & Southern Railroad, N 09° 54' 31" W – 984.23 feet to a point at the southerly corner of the Norfolk & Western Railroad Company land; thence with the easterly line of the Norfolk & Western Railroad Company land, N 21° 35' 06" E – 535.50 feet to the point of beginning.

Containing . . . . . 21.791 Acres, More or Less

EXHIBIT B

AVTEX FIBERS SUPERFUND SITE—MAP OF THE SITE

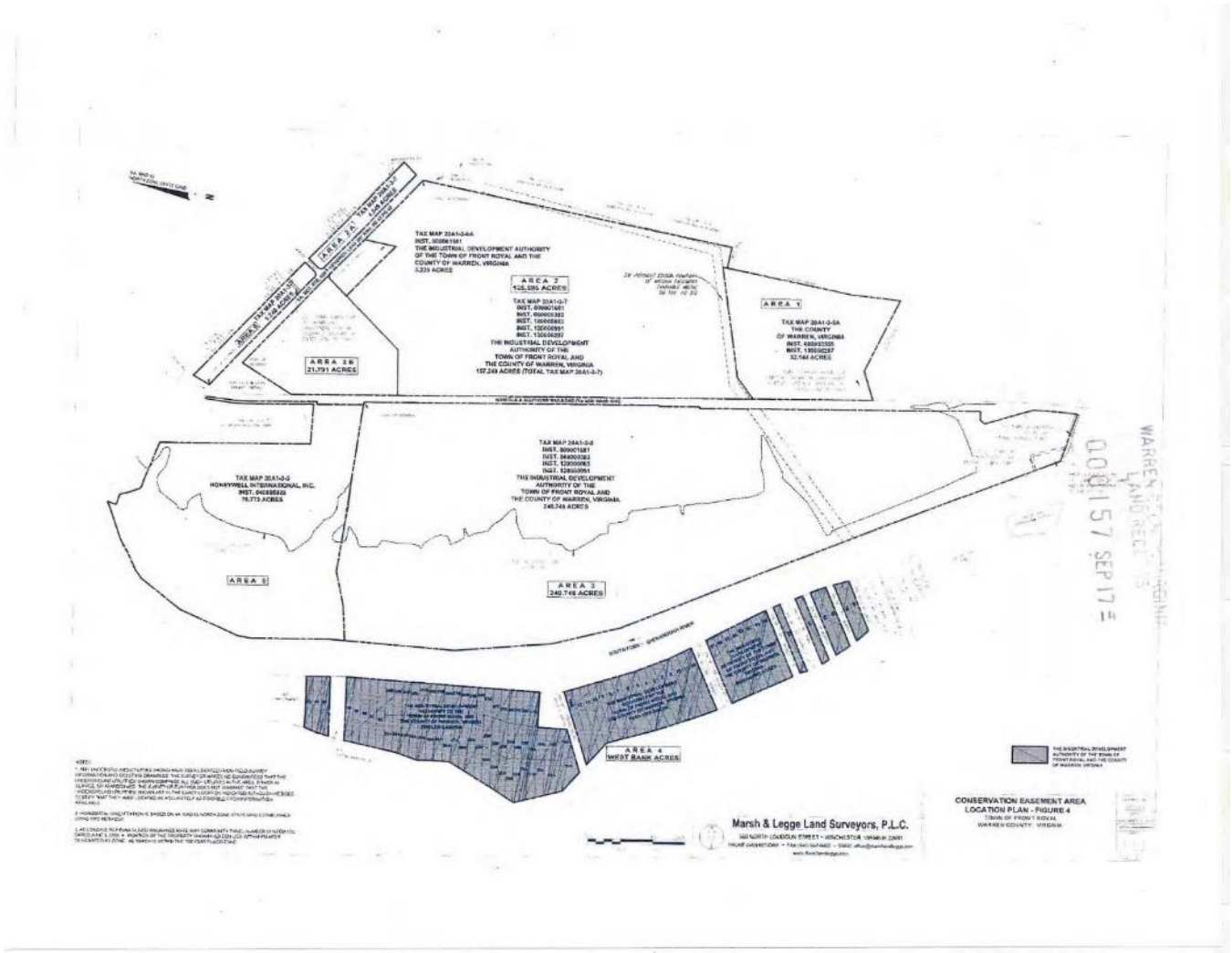
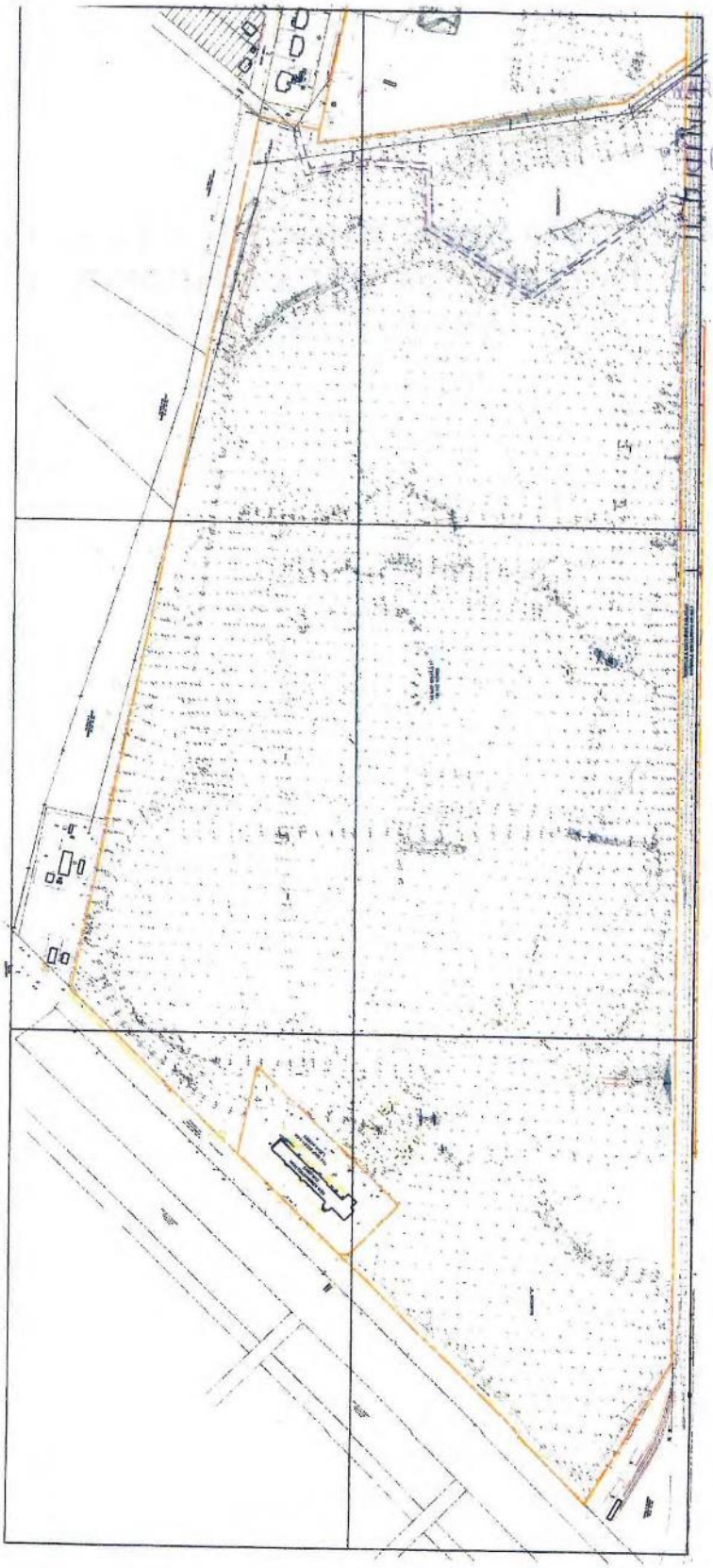

AREA 1
AREA 2
125.595 ACRES
AREA 2A
AREA 2B
21.791 ACRES
AREA 3
240.749 ACRES
AREA 4
WEST BANK ACRES
AREA 5
TAX MAP 20A1-3-5A
THE COUNTY
OF WARREN, VIRGINIA
32.144 ACRES
TAX MAP 20A1-3-7
THE INDUSTRIAL DEVELOPMENT
AUTHORITY OF THE
TOWN OF FRONT ROYAL AND
THE COUNTY OF WARREN, VIRGINIA
137.249 ACRES (TOTAL TAX MAP 20A1-3-7)
TAX MAP 20A1-3-6
THE INDUSTRIAL DEVELOPMENT
AUTHORITY OF THE
TOWN OF FRONT ROYAL AND
THE COUNTY OF WARREN, VIRGINIA
240.749 ACRES
TAX MAP 20A1-3-5
HONEYWELL INTERNATIONAL INC.
78.773 ACRES
Marsh & Legge Land Surveyors, P.L.C.
CONSERVATION EASEMENT AREA
LOCATION PLAN - FIGURE 4
TOWN OF FRONT ROYAL
WARREN COUNTY, VIRGINIA
WARREN COUNTY, VIRGINIA
LAND RECORDS
00 01 57 SEP 17

EXHIBIT C

AVTEX FIBERS SUPERFUND SITE—CONTOUR MAP OF AREAS 2, 2A AND 2B



WARREN COUNTY, VIRGINIA
LAND RECORDS
000159 SEP 17

Exhibit C

EXHIBIT D

AVTEX FIBERS SUPERFUND SITE—LIST OF EXISTING LIENS AND ENCUMBRANCES FOR AREAS 2, 2A AND 2B

WARREN COUNTY, VIRGINIA
LAND RECORDS

000161 SEP 17

EASEMENTS, RIGHT OF WAY & RESERVATIONS:
Encroachment Agreement dated 10/07/2010 and recorded 11/05/2010 in Instrument No. 100005811.
Deed of Dedication and Right of Way, dated 12/20/2002 and recorded 02/04/2003, in Instrument No. 030001131.
Agreement and Deed of Easement, dated 06/21/2002 and recorded 08/29/2002, in Instrument No. 020007501.
Site Access Agreement dated 02/20/2008 and recorded 02/21/2008 in Instrument No. 080001128.

Easement Clarification Agreements Recorded in Instrument Nos. 120000863 and 120000991.

INSTRUMENT #140004561
RECORDED IN THE CLERK'S OFFICE OF
WARREN COUNTY ON
SEPTEMBER 17, 2014 AT 03:58PM

JENNIFER P. SIMS, CLERK
RECORDED BY: SFK

APPENDIX G – SITE INSPECTION PHOTOS

Sign posted at the gated entrance to the Site and GLTP

View of the GLTP, looking east

Carbon filtration units inside the GLTP

Filter press room inside the GLTP

Metals precipitation tanks on the tank deck at the GLTP

Hydrogen sulfide gas monitor on the tank deck at the GLTP

View of VB 9, looking northwest. The PRP is aware of the two bare low spots (shown on the left side of the photo) and plans to address the areas in the fall of 2017

View of VB 10, looking southwest

Exterior of the VB extraction equipment building

Interior of the VB extraction equipment building

View of former WWTP polishing basin (PB 3)

Outfall 004 and the South Fork Shenandoah River

Signage posted facing the river at Outfall 004

Carbon filtration unit installed on VB 5 at OU10 GV-04

View of clean-closed sulfate basin, SB 2

Stormwater discharge outlet at SB 2

Stormwater discharge culvert from SB 2

Deep groundwater extraction well TW-01

Pond on the southern end of the Site


Solar-powered receiver receives monitoring well data from across the river

Restored wetland area

One of the several passive gas vents on one of the Site's basins

View of the NLF, looking south

VB 6 stormwater discharge chute

Previously unidentified bare spot observed on SB 3 near GV-8. The PRP is aware of the maintenance issue and plans to address the issue in the fall of 2017

View of FAB 6, looking south

The Norfolk Southern rail line that runs north-south through the center of the Site

View of the former plant area side of the Site, looking west

Site property on the west side of the river

Locked monitoring well on the west side of the river

Deep groundwater extraction well TW-03, located within a locked enclosure on the west side of the river


Kendrick Lane entrance to the former administration building complex on-site

The former American Viscose Corporation administrative building now houses several small businesses

Sign at the entrance to the on-site Skyline SoccerPlex

Playground at the Skyline SoccerPlex

New walking trails at the Skyline SoccerPlex

Soccer fields at the Skyline SoccerPlex

Skate park at the Skyline SoccerPlex

Land-moving efforts underway to facilitate site redevelopment (future planned location of a data center, part of the Royal Phoenix development)

APPENDIX H – DETAILED DATA ANALYSIS

This data review evaluates groundwater, surface water, sediment and aquatic biota data collected as part of long-term monitoring requirements for OU7, OU10 and the NTCRA Basins and presented in the 2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins Report (2015 Annual Report).

H.1 OU7

H.1.a OU7 Groundwater

The OU7 monitoring network includes 74 wells; 52 wells are sampled annually. Figure H-1 in this appendix shows the locations of the wells. The wells monitor four flow zones: overburden, shallow bedrock, intermediate bedrock and deep bedrock. Eleven of the 52 sampled wells also serve as VSWMR compliance wells for the closed VB 9-11 units. Three recovery wells (TW-01, TW-02 and TW-03) currently operate at the Site. Consistent operation of wells TW-01, TW-02, and TW-03 began in June, March and August 2015, respectively. Extraction wells TW-01 and TW-02 are both screened from (approximately) +200 feet mean sea level (MSL) to +460 feet MSL, while TW-03 is screened from (approximately) +15 feet MSL to +335 feet MSL.

2015 Capture Zone Analysis

PRP contractors collect water level data on a quarterly basis to support capture zone analyses. In support of the 2015 Capture Zone Analysis (CZA), the OU-7 monitoring wells were gauged four times during 2015 (March 18, July 7, September 15, and December 8).

Under non-pumping conditions, groundwater under the Site (on the east side of the river) generally flows to the west toward the river. However, groundwater within the bedrock aquifer flows southwest parallel to a geologic strike. In the subdivisions on the west side of the Shenandoah River, groundwater typically flows to the east and southeast, toward the river. Figures H-2 through H-21 in this appendix present groundwater elevation contours for the overburden, shallow bedrock, intermediate bedrock and deep bedrock created using data collected quarterly during 2015, from both during and after consistent operation of the recovery wells.[7] Interpretation of those groundwater elevation contour maps indicates:

- The Overburden figures (H-2 through H-5) show a linear effect slightly off-axis to TW-01/TW-02. There are dewatering wells in the overburden in the region of the VBs that would add to any effect pumping from TW-01/TW-02 would have on the overburden.
- The Shallow Bedrock figures (H-7 through H-10) clearly show the effect of TW-02 pumping and the initial effects of TW-01 pumping (particularly Figures H-8, H-9, and H-10).
- The Intermediate Bedrock figures for July, September, and December (Figures H-13, H-14, and H-15, respectively) show a well-defined cone of depression between wells TW-01 and TW-02, and suggest that it extends to the opposite side of the river.
- The Deep Bedrock figures for July, September, and December (Figures H-18, H-19, and H-20, respectively) show more variation in monitored water levels; however, there does appear to be a well-defined cone-of-depression between wells TW-01 and TW-02. (there is only about 1 foot of difference in head between well cluster 501, near well TW-03, and well pair 606, located southeast of TW-03).

[7] Figures H-2 through H-21 also include groundwater drawdown maps.

Maximum site-wide drawdown (as defined as the difference between the March 18 hydraulic heads and those measured in July, September, and December) was observed during the September 15th gauging event. Maps of hydraulic head drawdown were created using this data for the four subsurface zones (Figures H-6, H-11, H-16, and H-21). Interpretation of the hydraulic head drawdown maps indicates:

- The overburden drawdown (Figure H-6) indicates that there may be more influence on the overburden near well TW-01 than near well TW-02. Up to 1 foot of drawdown may be due to natural seasonal variation.
- The shallow bedrock drawdown (Figure H-11) shows a well-developed cone of depression extending between wells TW-01 and TW-02, and extending across the river. Natural seasonal variation may account for 1 to 2 feet of observed drawdown.
- The intermediate bedrock drawdown (Figure H-16) is similar to the shallow bedrock zone. Natural seasonal variation may account for 2 feet of observed drawdown.
- The deep bedrock drawdown (Figure H-21) also indicates an elongated cone of depression that extends from TW-02 through TW-01 and across the river to TW-03. Drawdown values, however, are more variable, possibly indicating less well-connected fractures. Natural seasonal variation may account for 2 feet of observed drawdown (including negative drawdown, associated with a rise in water levels).

Four hydrogeologic cross-sections also were created using the hydraulic head data from September and groundwater sample analyses from July 2015. Interpretation of the hydrogeologic cross-sectional flow maps indicate:

- Cross-section A-A' (Figure H-22) shows a nicely defined flow toward TW-02, and clearly shows another zone developing around well TW-01.
- Cross-section B-B' (Figure H-23) shows a well-defined area of capture around TW-02.
- Cross section C-C' (Figure H-24) shows a tighter zone of capture around TW-01. The southernmost region (near C') is outside of the capture.
- Cross-section D-D' (Figure H-25) shows the effects of pumping from across the river in the central portion of the cross-section. The capture zone created by pumping at TW-03 has now extended to the southeast of TW-03.

The CZA also includes determining a "stagnation point" (the downgradient point where there is a groundwater divide; groundwater flows back toward the recovery well, or downgradient away from the well), and a maximum capture zone "width." The CZA determines stagnation points through the review of the drawdown maps and potentiometric surface maps. Where the capture zones for TW-01 and TW-02 have combined, there is only one stagnation point downgradient from well TW-01. Capture zones were only interpreted for zones where groundwater recovery is taking place.

- In the shallow bedrock, the stagnation point appears to be on the opposite side of the river, about 1,000 feet downgradient fromTW-01. The maximum capture zone width is around 2,000 feet at TW-02 (i.e., 1,000 feet cross gradient to either side of TW-02) and 600 feet at TW-01.
- In the intermediate bedrock, the stagnation point appears to be on the opposite side of the river, about 800 feet downgradient from TW-01. The maximum capture zone width is around 1,400 feet at TW-02 and 1,200 feet at TW-01.
- In the deep bedrock, the variability in groundwater levels results in a less straightforward determination. The stagnation point appears to be on the opposite side of the river, 800 feet downgradient fromTW-03. The maximum capture zone width is around 1,000 feet at TW-02, 1,600 feet at TW-01, and 600 feet at TW-03.

Results of 2015 CZA suggest that:

- There is a well-developed cone of depression in the shallow and intermediate bedrock between wells TW-01 and TW-02 and extending across the river.
- The deep bedrock drawdown indicates an elongated cone of depression that extends from TW-02 through TW-01 and across the river to TW-03. However, drawdown values are more variable in this zone, possibly indicating less well-connected fractures.
- The effects of pumping from across the river are evident, and the capture zone created by pumping at TW-03 has now extended to the southeast of TW-03.

Groundwater Quality

The Sitewide GWMP, OU-7, OU-10 and NTCRA-Basins, dated February 3, 2015 indicates that the wells used to assess the effectiveness of capture will be sampled initially in 2013 before the recovery and treatment system is brought online, six months after system start-up and annually thereafter. Groundwater samples will be analyzed for the 22 groundwater COCs listed in the OU7 ROD (two VOCs, six SVOCs, 13 metals and cyanide). The 2015 sampling event represents the first annual event for the OU7 monitoring program. This FYR evaluates the 2015 data in detail and presents limited historical data to provide context for the evaluation. Table H-5, starting on page H-46 of this appendix, presents the 2015 results for OU7 wells. Refer to the 2015 Annual Report for historical analytical results for OU7 groundwater.

During the 2015 sampling event, carbon disulfide was the only VOC to be detected above its OU7 remedial goal of 1,000 µg/L. Carbon disulfide was detected in 32 wells and appeared in each of the four flow zones. Detected concentrations exceeded the carbon disulfide remedial goal in five wells (shallow bedrock well MW-03R, intermediate bedrock wells 205 and 206 and deep bedrock wells 305 and 336.) This is a decrease from 2014, when carbon disulfide was detected in 34 wells and exceeded the remedial goal in 11 wells. Table H-1 below summarizes recent sampling results for the five wells with reported exceedances in 2015. Carbon disulfide concentrations are generally decreasing in wells MW-03R, 206 and 305, but increasing in 205 and 336. However, carbon disulfide concentrations in 205 remain below historical concentrations. Figure H-26 in this appendix shows that all detections of carbon disulfide in the overburden in 2015 were below the remedial goal; therefore, this is no defined plume in the overburden.

Figures H-27 through H-29 of this appendix show the extent of the carbon disulfide above the remedial goal in the shallow, intermediate and deep bedrock flow zones. Carbon disulfide in the shallow bedrock is limited in extent and centered around MW-03R, located immediately adjacent to the viscose basins. The extent of carbon disulfide above the remedial goal in the intermediate and deep bedrock are much larger and extend from the viscose basins southwest to the western side of the river. Recovery well TW-03, which began continuous operation after the 2015 sampling event, is located south of 206 and is expected to capture contamination in this area. Additional monitoring will determine the effectiveness of groundwater extraction in this area.

Table H-1: Carbon Disulfide Concentrations in Select Wells, 2012-2015

Year	Shallow Bedrock Wells	Intermediate Bedrock Wells		Deep Bedrock Wells	
	MW-03R	205	206	305	336
2012	NS	**9,450 µg/L**	**11,600 µg/L**	**39,600 µg/L**	**11,500 µg/L**
2013	**6,930 µg/L**	203 µg/L	**12,000 L µg/L**	**39,900 µg/L**	**9,690 µg/L**

2014	**4,290 µg/L**	90.5 µg/L	**8,100 µg/L**	**41,100 µg/L**	**10,200 µg/L**
2015	**2,600 µg/L**	**1,300 µg/L**	**7,500 µg/L**	**28,000 µg/L**	**14,000 µg/L**

Notes:
NS = not sampled
L = reported value may be biased low
Table includes the greater of the primary and duplicate sample results.
Bold results exceed the carbon disulfide remedial goal of 1,000 µg/L.

During the 2015 sampling event, overburden well MW-09 was the only well to report SVOC detections above the OU7 remedial goals. 4-methylphenol and phenol were detected in groundwater at this location at concentrations of 190 µg/L and 25,000 µg/L, respectively, which exceed the cleanup standards for these COCs of 180 µg/L and 11,000 µg/L, respectively. SVOCs were not detected above the OU7 remedial goals in the shallow, intermediate or deep groundwater, which is consistent with recent historical results.

During the 2015 sampling event, concentrations of nine metals (antimony, arsenic, chromium, cobalt, iron, lead, manganese, nickel and vanadium) exceeded their respective OU7 remedial goals in at least one monitoring well. All other metals and cyanide were either not detected or were detected below remedial goals. Although cyanide was not detected in any 2015 sample, the detection limit for cyanide in several samples, including deep bedrock well 305, exceeded the cyanide cleanup goal of 200 µg/L. Deep bedrock well 305 reported cyanide above the cleanup goal during sampling events in 2012, 2013 and 2014. The lack of detectable cyanide at this location in 2015 is likely due to laboratory issues that resulted in an elevated detection limit.

Arsenic and antimony are the two most widespread inorganic constituents in groundwater at OU7 and serve as reasonable indicator constituents for delineating the extent of all inorganic constituents. Therefore, this FYR addresses arsenic and antimony in more detail below.

Arsenic was detected above its remedial goal of 10 µg/L in three overburden wells (MW-09, WP-10 and MW-10), five shallow bedrock wells (116R, 133, 138, GM-02A and MW-03R), six intermediate bedrock wells (205, 206, 216, GM-02B, PW-02 and 238) and 7 deep bedrock wells (305, 316, 336, 306, 338, 603[8] and 605A) during the 2015 sampling event. The two highest concentrations were reported in deep bedrock well 305 (3,010 µg/L), located downgradient of the VBs and close to recovery well TW-01, and overburden well MW-09 (2,480 µg/L), located immediately downgradient of VB-9. Table H-2 below summarizes recent sampling results for wells MW-09 and 305. Arsenic concentrations in both wells have been variable over the past four years, but have increased overall since 2012. Figures H-2 through H-5 present arsenic isoconcentration contours from the 2015 sampling event for the four groundwater flow zones.

Table H-2: Dissolved Arsenic Concentrations in Select Wells, 2012-2015

Year	Overburden Well	Deep Bedrock Well
	MW-09	**305**
2012	**2,080 µg/L**	**2,300 µg/L**
2013	**1,460 µg/L**[a]	**1,560 µg/L**
2014	**2,180 µg/L**[a]	**1,720 µg/L**
2015	**2,480 µg/L**	**3,010 µg/L**

Notes:

[8] Well 603 is a deep bedrock well fitted with FLUTe liners with sample ports in four depth zones (Z1 through Z4). During 2015 sampling, arsenic was detected above its remedial goal in all four deep bedrock zones of well 603.

a. MW-09 was sampled twice in 2013 and 2014. The highest detected concentration from each year is presented in the table.
NS = not sampled
Table includes the greater of the primary and duplicate sample results.
Bold results exceed the arsenic remedial goal of 10 µg/L.

Antimony was detected above its remedial goal of 6 µg/L during the 2015 sampling event at one overburden well (MW-09), two shallow bedrock wells (116R, MW-03R), five intermediate bedrock wells (205, 206, 216, GM-02B and 238) and three deep bedrock wells (305, 316 and 336). Intermediate bedrock well 205 and deep bedrock wells 305 and 336 reported the highest concentrations during the 2015 sampling event. Table H-3 summarizes recent sampling results for these wells. Antimony concentrations in these wells has been variable between 2012 and 2015, but generally decreasing in well 205 and stable in well 336. Deep bedrock well 305 shows an increase in concentrations between 2012 and 2015, which is also consistent with the trend for arsenic in this well. Figures H-26 through H-29 present antimony isoconcentration contour maps for the 2015 sampling event for the four groundwater flow zones. The extent of antimony above its remedial goal in the overburden and shallow bedrock are immediately downgradient of the VBs and contained on the east side of the river. Antimony in the intermediate and deep bedrock extends southwest from the VBs and across the river to the west. In the intermediate bedrock, the southwestern extent of antimony reported above its remedial goal appears undefined beyond well 206. However, pumping well TW-03 is located south of 206 as is expected to capture contamination in this area.

Table H-3: Dissolved Antimony Concentrations in Select Wells, 2012-2015

Year	Intermediate Bedrock Well	Deep Bedrock Wells	
	205	305	336
2012	**497µg/L**	**550 µg/L**	**314 µg/L**
2013	**222 µg/L**	**319 µg/L**	**63.9 µg/L**
2014	**384 µg/L**	**1,100 µg/L**	**312 µg/L**
2015	**225 µg/L**	**685 µg/L**	**320 µg/L**

Notes:
NS = not sampled
Greater of the primary and duplicate sample results are included in the table.
Bold results exceed the antimony remedial goal of 6 µg/L.

Results from the 2015 sampling event generally show consistent or decreasing concentrations for most other inorganic COCs. An exception is iron and manganese at overburden well MW-10. Iron and manganese concentrations in 2015 are several orders of magnitude higher than recent concentrations measured at MW-10, located downgradient of VB 10. The 2015 Annual Report indicates that the reason for the increase in iron and manganese concentrations is not clear. Turbidity and other field parameters were not significantly different from past results.

VSWMR Compliance Monitoring

Eleven of the 52 sampled wells in the OU7 groundwater monitoring network also serve as VSWMR compliance wells (Figure H-30). One aspect of the compliance monitoring program is to evaluate contaminant trends. In accordance with the OU7 GWMP, the control chart approach was selected as the method to evaluate the data collected in each downgradient well. A control chart is a plot of concentration versus time, with an established concentration limit for baseline that, if exceeded, will indicate an increase in concentration over the baseline. Baseline concentrations for each parameter at each well were established from the initial four semiannual sampling results conducted in 2013 and 2014. A review of the control charts for the 2015 sampling event, which are included in the 2015 Annual Report, indicates that

most constituents remain below their baseline concentrations, with the exceptions listed in Table H-4. These constituents were not significantly above their baseline concentrations. Additional data are required to establish a statistically significant pattern showing an increase in the groundwater concentrations.

Table H-4: Baseline Concentration Exceedances at VSWMR Compliance Wells in 2015

Well	Constituent	Baseline Concentrations (µg/L)	2015 Result (µg/L)
MW-09	4-methylphenol	80.8	190
MW-09	phenol	17,300	25,000
MW-09	arsenic	2,180	2,480
MW-09	chromium	119	144
MW-09	cobalt	637	758
MW-09	nickel	1,640	2,140
MW-09	vanadium	476	619
WP-10	cobalt	167	174

H.1.b OU7 Surface Water and Sediment

Surface water and sediment samples were collected annually, beginning in 2012. Surface water and sediment samples were collected at eight locations (numbered SED/SW-1 through SED/SW-8) in the river and analyzed for 13 metals (dissolved for surface water, total for sediment), free cyanide (surface water), total cyanide (sediment), three VOCs and six SVOCs. Sediment samples were also analyzed for grain size. Prior to 2015, only seven surface water/sediment samples were collected annually. Figure H-31 presents the 2015 surface water and sediment sampling locations with the exception of the newly added SED/SW-8, which is upstream of the Site.

Surface Water

VOCs, SVOCs and cyanide were not detected in surface water samples collected between 2012 through 2015, except for a low-level detection of carbon disulfide in SW-07 in 2013. The detected concentration (1.11 B µg/L) was qualified because the constituent was also detected in the associated blank sample. Table H-6 at the end of this appendix presents the 2015 surface water sampling results. Refer to the 2015 Annual Report for historical analytical results for OU7 surface water.

Various metals have been detected in surface water samples since sampling began. During the 2015 sampling event, concentrations of metals in river surface water samples were reported as non-detect or at concentrations below the VA DEQ Surface Water Criteria for Public Water Supply at all sampling locations. This is consistent with historical results.

Sediment

Carbon disulfide and acetone were routinely detected in sediment samples between 2012 and 2015. Carbon disulfide concentrations in all sediment sample locations exceeded the EPA Region 3 freshwater sediment screening benchmark during the 2015 sampling event. This is consistent with historical results. There is no established screening value for acetone. Table H-7 at the end of this appendix presents a summary of 2015 sediment sampling results. Refer to the 2015 Annual Report for historical analytical results for OU7 sediment.

SVOCs were generally not detected or were detected below the sediment screening benchmarks between 2012 and 2015. The exception is a detection of 4-methylphenol at a concentration of 1,600 µg/kg in SD-8

during the 2015 sampling event (compared to its screening benchmark of 670 µg/kg). Naphthalene and phenol were also detected at this location, but the concentrations did not exceed the screening benchmarks. Sediment sample location SD-8 is upstream of the Site; therefore, the detected SVOCs are not believed to be related to site activities. SD-8 is also a new sample location added in 2015, so there are no other data available from this location. SD-8 will be included in future monitoring events.

Metals are also routinely detected at all the sediment sampling locations. During the 2015 sampling event, three metals exceeded their screening benchmarks: mercury (SD-04, SD-07, SD-08), manganese (SD-04, SD-06, SD-08) and iron (SD-08). SD-08, the new upstream location for 2015, reported the most exceedances of screening criteria. The concentrations of metals detected in sediments in 2015 are relatively consistent with results reported from previous years.

Consistent with historic results, total cyanide was not detected in any of the samples in 2015.

H.1.c OU7 Aquatic Biota

Triennial aquatic biota sampling is conducted to determine whether there are decreasing trends in the concentration of PCBs found in the aquatic biota (i.e., fish and macroinvertebrates) that reside adjacent to the Site. During the 2015 sampling event, samples were collected at six aquatic biota sampling locations (BMI-1 through BMI-6). Figure H-32 presents the aquatic biota sampling locations. A summary of the results is presented below. Refer to the 2015 Annual Report for current and historical analytical results for OU7 aquatic biota.

Fish

- *Smallmouth bass:* PCBs were detected in 13 of 18 whole-body bass samples. PCBs were only detected in one filet sample. The concentrations detected in 2015 were generally lower than those detected in past events. PCB concentrations detected in nine of the samples exceeded the VA DEQ Fish Screening Value for PCBs of 0.020 mg/kg.
- *Redbreast sunfish:* PCBs were detected in six of the 15 whole-body sunfish samples. Aroclor 1260 was the only Aroclor detected. Detected concentrations were generally lower than those previously detected. Five of the six PCB concentrations detected exceeded the screening value.
- *Northern hogsucker and fallfish:* PCBs were detected in eight of 13 whole-body northern hogsucker and fallfish samples. Aroclor 1260 was the only Aroclor detected. Only one sample from this category was collected in 2012 (a single V-lip sucker was collected at BMI-5). While no PCBs were detected in that sample, the detection limit for the 2012 sampling was higher than the values detected in 2015. PCB concentrations exceeded the screening criterion in four of the eight samples.
- *Comely shiner:* PCBs were detected in 15 of the 16 whole-body comely shiner samples. Aroclor 1254 was detected in one sample from location BMI-2. Aroclor 1260 was the only Aroclor detected in the remaining samples. The comely shiner was collected in lieu of bluntnose minnow samples collected in 2012. The PCB concentrations in the comely shiner samples are similar to those found in the bluntnose minnow samples from 2012. The PCB concentrations exceeded the screening criterion in 11 of the 16 samples.

Significant decreases in PCB concentrations have been observed in the smallmouth bass and redbreast sunfish samples since 2012. Comparing the comely shiner to the previous bluntnose minnow results indicates similar concentrations between 2012 and 2015.

Benthic Macroinvertebrates (Fingernail Clams)

PCBs were detected in only one clam tissue sample (BMI-2) during the 2015 sampling event. Aroclor 1260 was the only Aroclor detected. Although no PCBs were detected in these samples in 2012, the laboratory reporting limits and method detection limits for PCBs during the 2015 event were an order of magnitude lower than those obtained in 2012. No VA DEQ screening value is available for shellfish not subject to human consumption.

Sediment

PCBs were not detected in any of the six sediments samples collected at the aquatic biota sampling stations during the 2015 sampling event.

H.2 OU10

H.2.a OU10 Groundwater

Nineteen overburden and shallow bedrock wells serve as monitoring wells for the OU10 post-closure monitoring program. Each sample is analyzed for dissolved metals, free cyanide, VOCs and SVOCs. The OU7 GWMP selected the control chart approach as the method for evaluating the data collected in each downgradient well. For most monitoring wells, the baseline period was completed with the October 2009 sampling event.

The 2015 sampling event represents the eighth annual monitoring event for OU10. Table H-7 at the end of this appendix presents the 2015 analytical results. Refer to the 2015 Annual Report for historical results.

Groundwater Elevations

The groundwater elevation contours for both the overburden and the shallow bedrock for July 2015 are shown on Figures H-33 and H-34 respectively. The groundwater contours for both the overburden and the shallow bedrock are similar to contour maps from previous monitoring events. Piezometric gradients are generally west to northwest toward the Shenandoah River. However, groundwater within the bedrock aquifer flows parallel to a geologic strike at approximately S30ºW.

Groundwater Quality

<u>VBs 1-8</u>
At VBs 1-8, arsenic, naphthalene, benzene and vinyl chloride concentrations exceeded the applicable RSL in one or more wells during the 2015 sampling event; however, in all but one case, the concentrations were below or within the baseline range for the well. The arsenic concentration at upgradient well 133 exceeded the RSL and was slightly above its baseline concentration.

At downgradient overburden well GPW-14, four constituents (acetone, methyl ethyl ketone, 2-hexanone and xylenes) exceeded their baseline ranges (although detected concentrations were below RSLs). Continued monitoring is necessary to determine if VBs 1-8 are causing an increase in these VOCs.

At downgradient shallow bedrock well 119, the xylene concentration was above the applicable baseline range (although detected at a concentration below the RSL). The 2015 exceedance is the first exceedance of baseline for xylenes. Continued monitoring will be necessary to determine if an increasing trend is present.

<u>The NLF</u>

At the NLF, the two wells representative of upgradient overburden groundwater quality have been sampled; all downgradient overburden monitoring wells have been dry during each of the monitoring events. Based on the dry conditions at the downgradient monitoring wells, it appears that minimal overburden groundwater is present beneath and downgradient of the NLF.

Carbon disulfide (well 133) and vinyl chloride (well MW-07) were the only VOCs detected in the shallow bedrock monitoring wells downgradient of the NLF during the 2015 sampling event. Both detections exceeded their respective baseline ranges (the vinyl chloride detection also exceeded the RSL). Carbon disulfide has been intermittently detected at well 133, and vinyl chloride has been present in well MW-07 since 2013. There are insufficient data to determine if the concentrations of these constituents are increasing or stable.

Concentrations of arsenic, beryllium, and nickel are elevated in the downgradient shallow bedrock wells compared to concentrations in the upgradient shallow bedrock wells; arsenic also exceeded its RSL in MW-07 and well 133. Except for arsenic at well 133, the detected concentrations for these metals were below or within the range of baseline values in their respective wells. Additional monitoring data are required to determine if an increasing trend for arsenic is present at this location.

H.3 NTCRA Basins

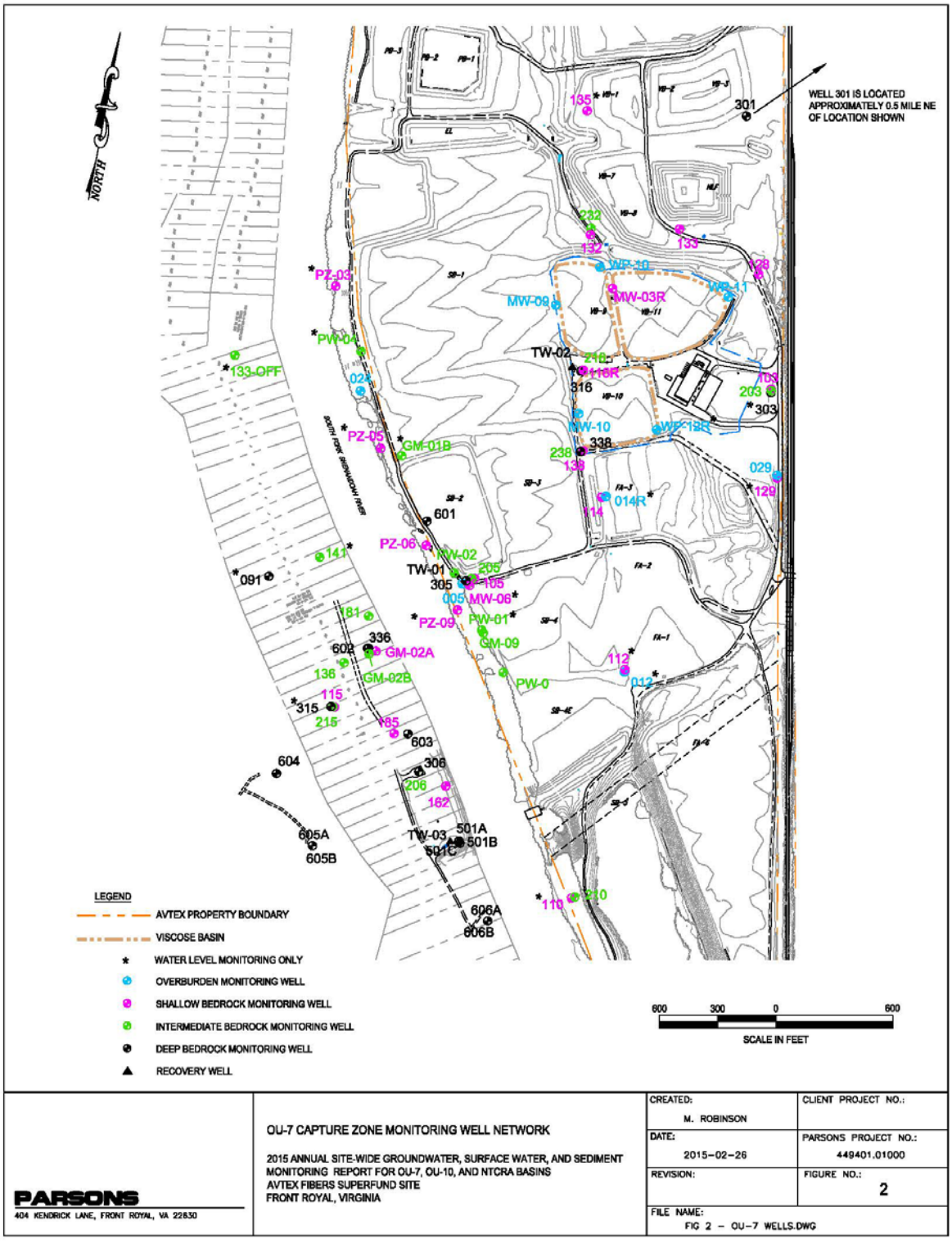
Twenty wells (10 overburden and 10 shallow bedrock) serve as VSWMR compliance wells for the NTCRA Basins, which consist of the Fly Ash Basins (FABs) and the Sulfate Basins (SBs) (Figures H-35 and H-36). Sumps for each cover system are also monitored. The 2015 sampling event represents the 15th year of annual sampling. Table H-8 of this appendix presents the 2015 analytical results. Refer to the 2015 Annual Report for historical results.

During the 2015 sampling event, arsenic was the only constituent detected in groundwater at concentrations exceeding the EPA tapwater RSL. This result is consistent with prior sampling events. Overburden well MW-014R reported the highest arsenic concentration in 2015 with a detection of 692 µg/L (compared to the current RSL of 0.052 µg/L and MCL of 10 µg/L). In accordance with the OU7 GWMP, the control chart approach was selected as the method to evaluate the data collected in each downgradient well. The control chart for well 014R is presented in the 2015 Annual Report. The control chart shows that the arsenic concentration in groundwater at well MW-014R has remained relatively stable since 2008. Control charts for other downgradient wells can be found in the 2015 Annual Report.

Several metals (arsenic, nickel and zinc) and sulfate were detected in samples collected from one or more of the FAB sumps above applicable screening criteria (the more stringent freshwater standards for either aquatic life or human health contained in the Virginia surface water quality standards). Concentrations have been relatively stable or decreasing in most sumps. Arsenic detected in sump FAB-1-2 increased by two orders of magnitude compared to the 2014 result. Additional data are required to determine if the increase at FAB-1-2 is an anomaly or represents a trend.

Arsenic, copper, nickel and sulfate concentrations exceeded screening criteria in one or more of the SB sumps during the 2015 sampling event. The concentrations of COCs in these sumps has decreased or remained generally stable over the monitoring period.

Figure H-1: OU7 Monitoring Well Network



Note: All figures in this appendix are from the Site's 2015 Annual Site-Wide Groundwater, Surface Water and Sediment Monitoring Report for OU-7, OU-10 and NTCRA Basins.

Figure H-2: OU7 Overburden Groundwater Contour Map (March 2015)

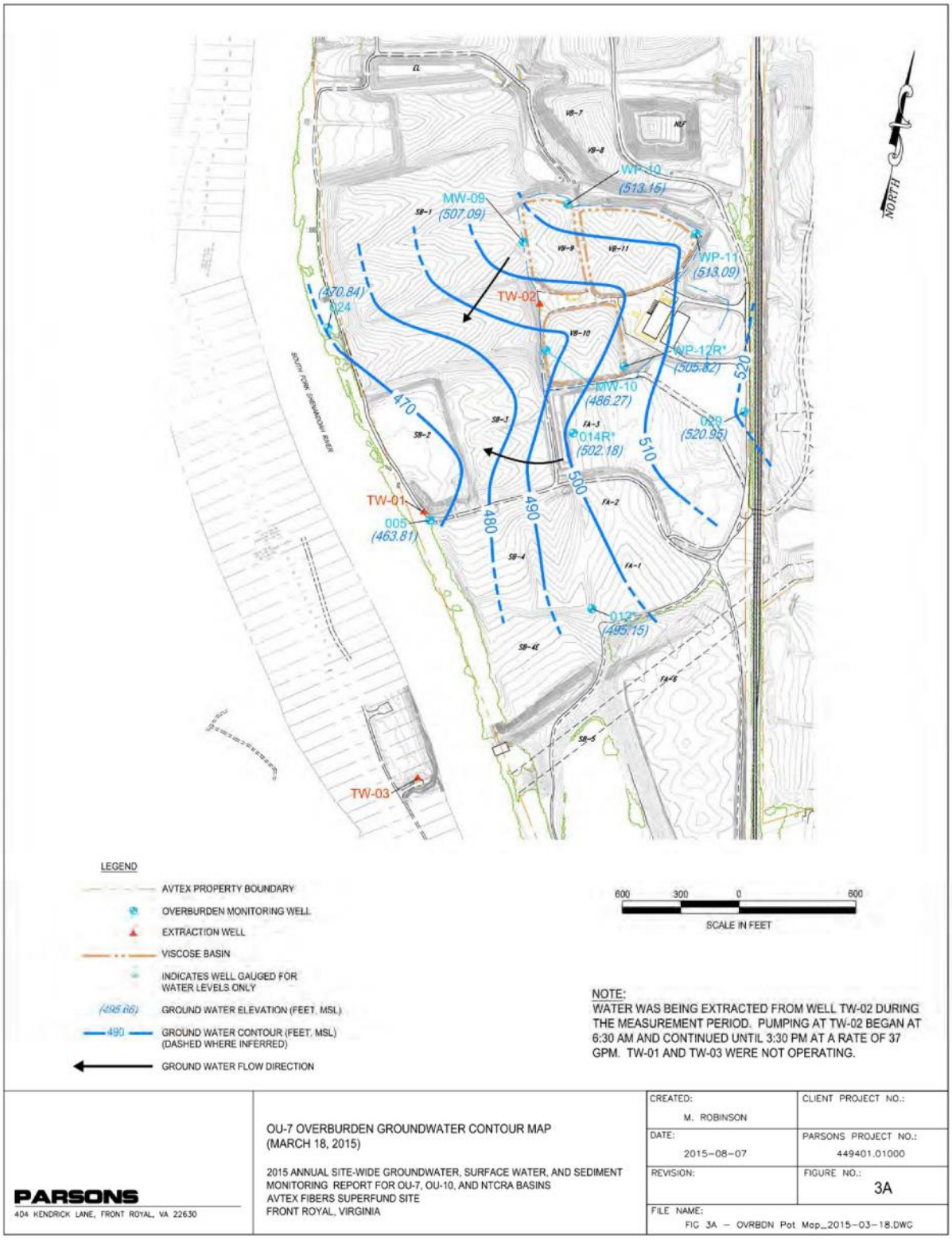


Figure H-3: OU7 Overburden Groundwater Contour Map (July 2015)

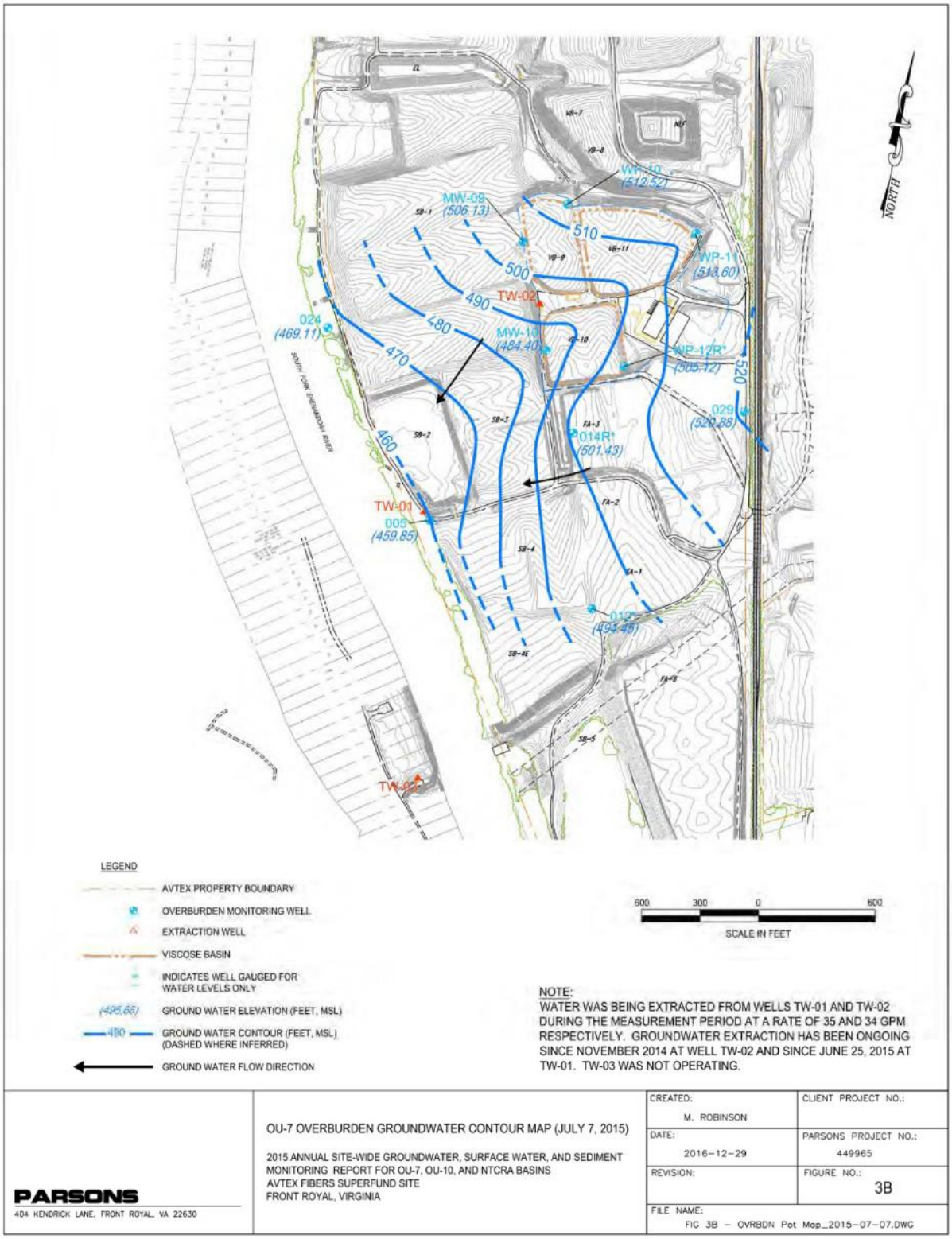


Figure H-4: OU7 Overburden Groundwater Contour Map (September 2015)

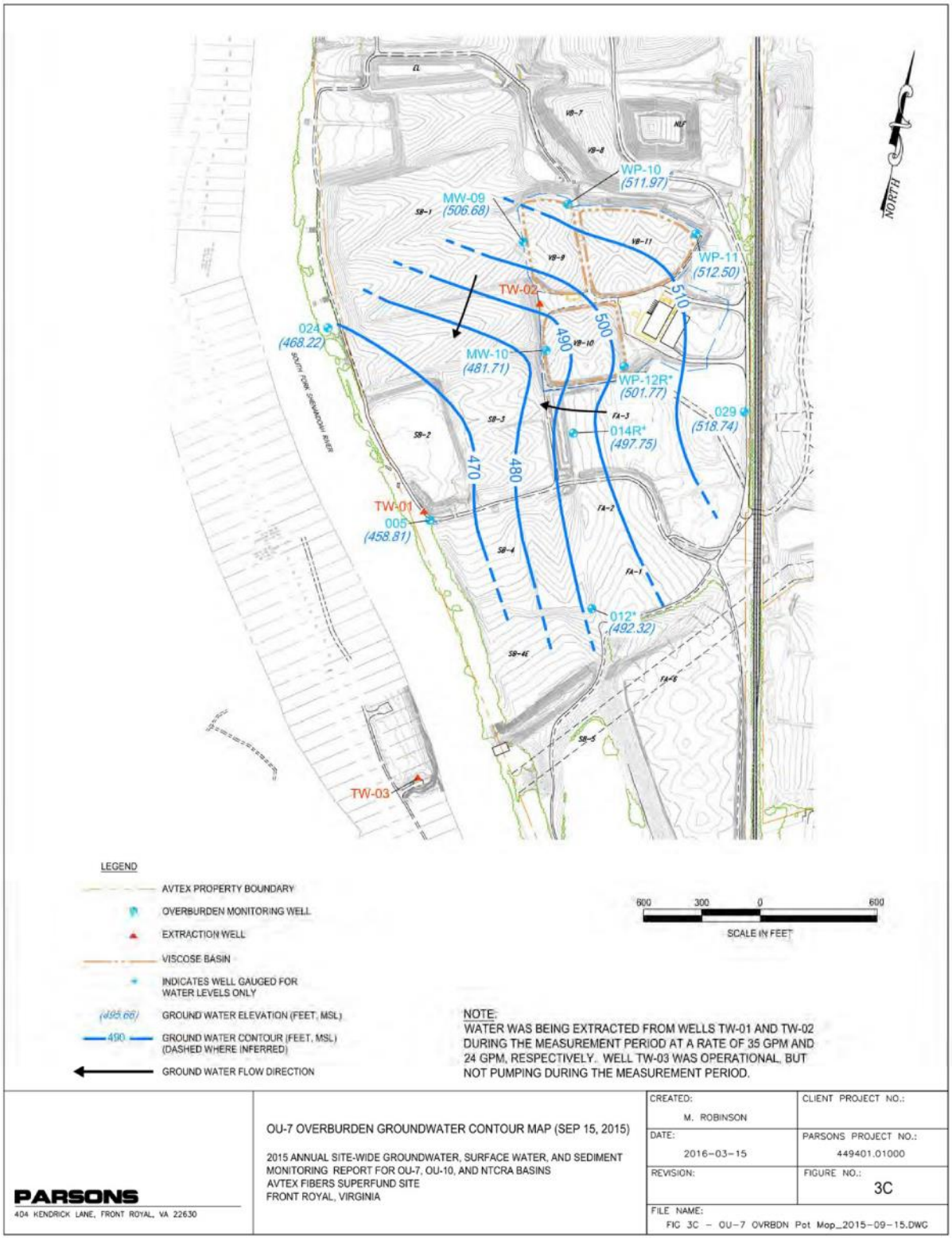


Figure H-5: OU7 Overburden Groundwater Contour Map (December 2015)

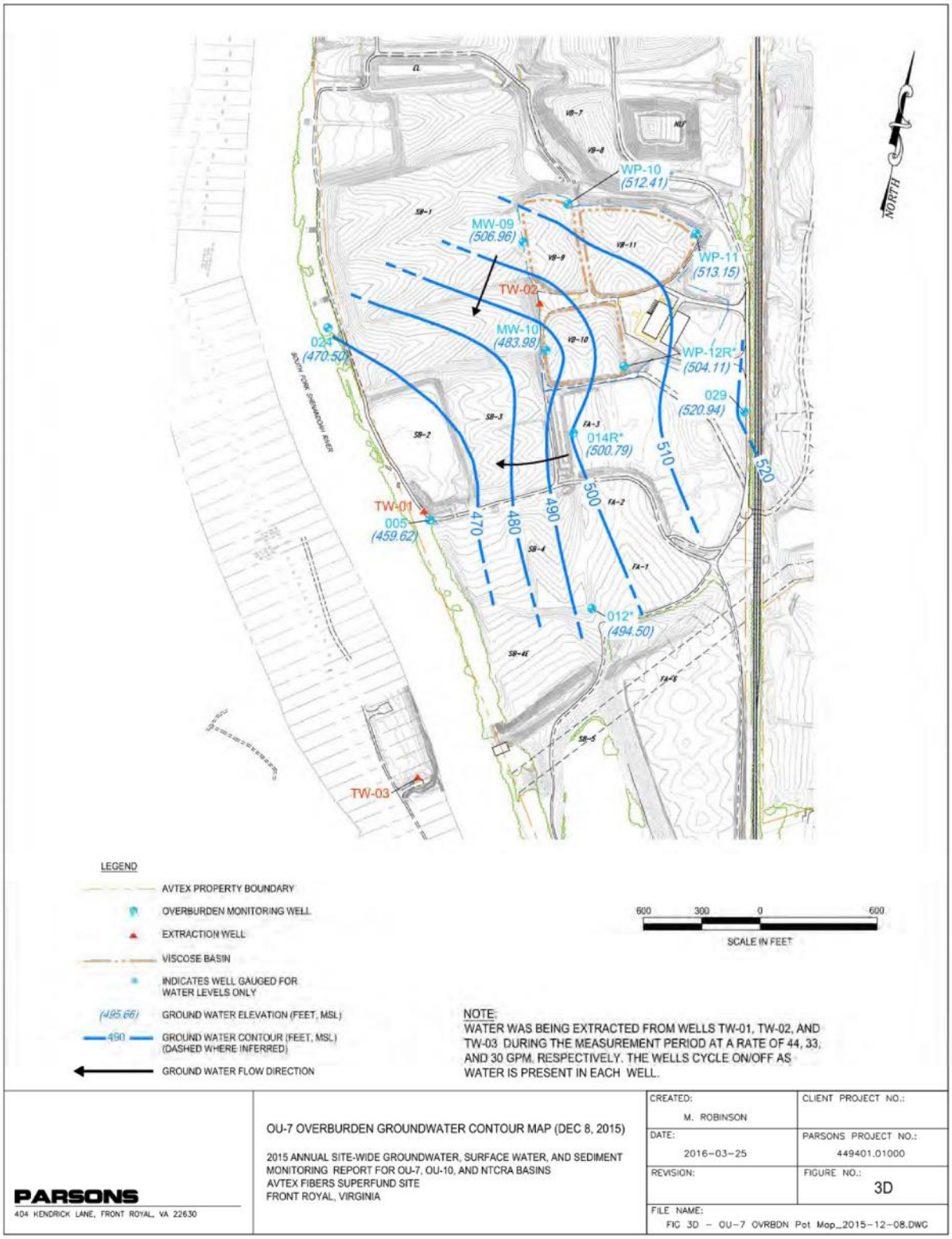


Figure H-6: OU7 Overburden Groundwater Drawdown Map (September 2015)

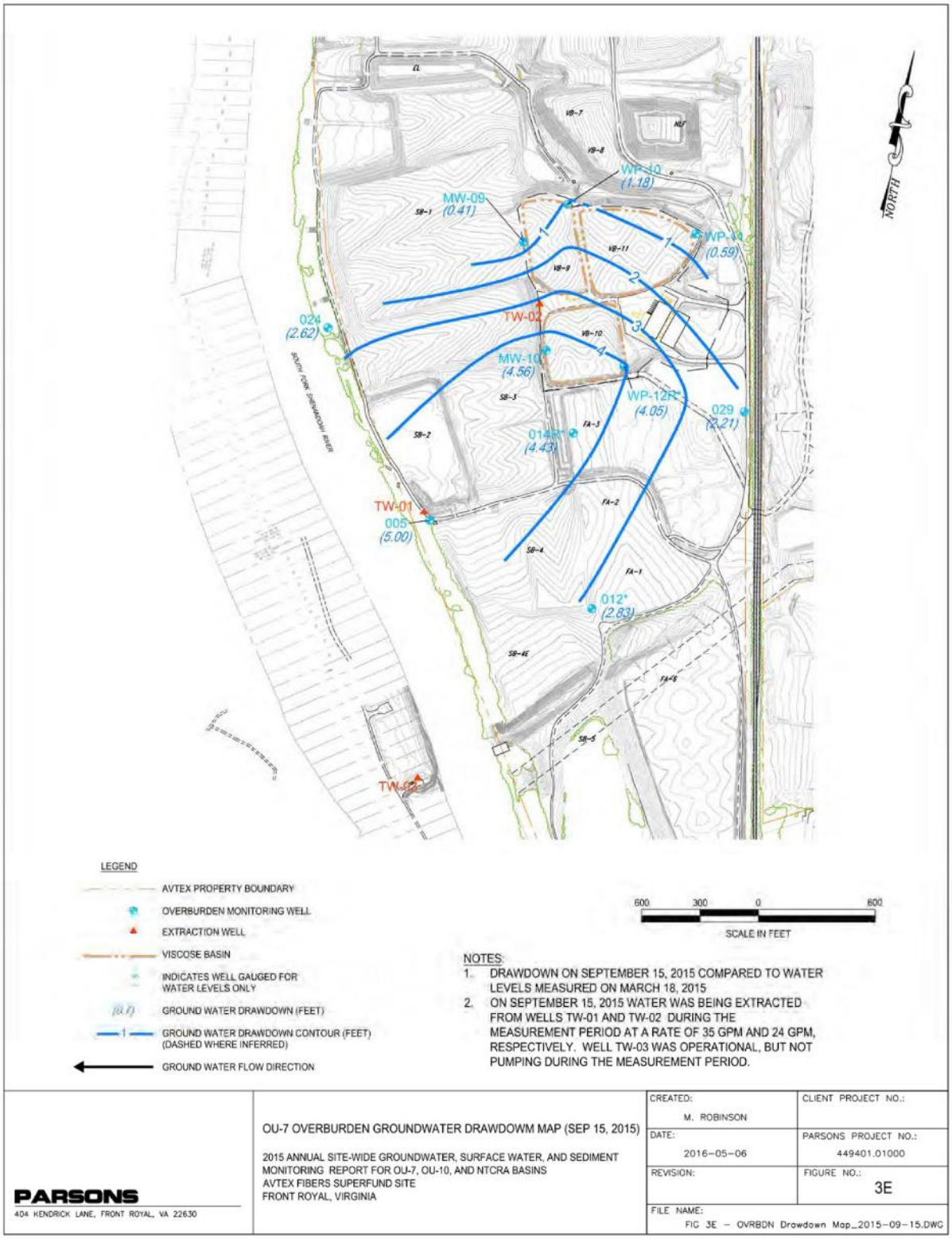


Figure H-7: OU7 Shallow Bedrock Groundwater Contour Map (March 2015)

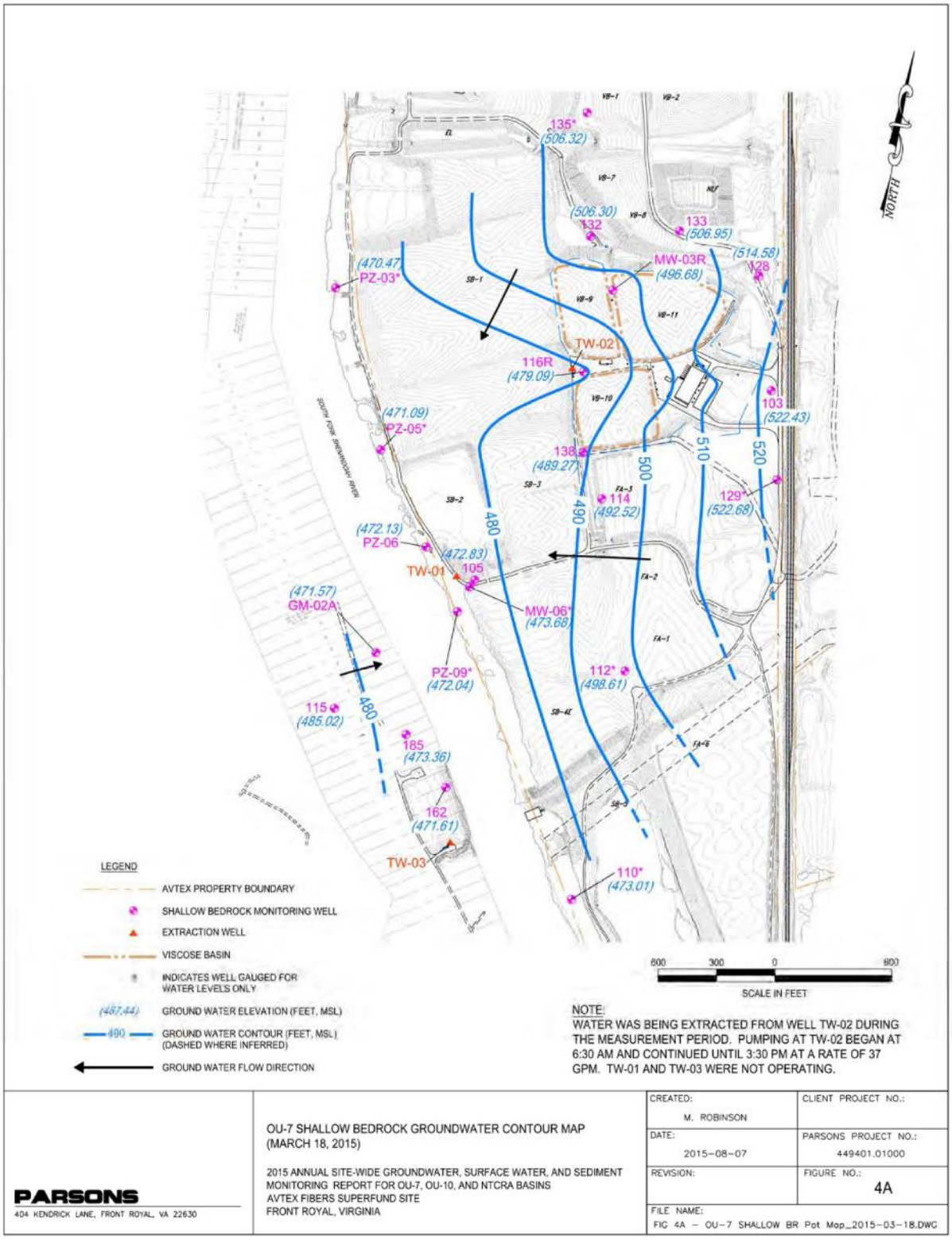


Figure H-8: OU7 Shallow Bedrock Groundwater Contour Map (July 2015)

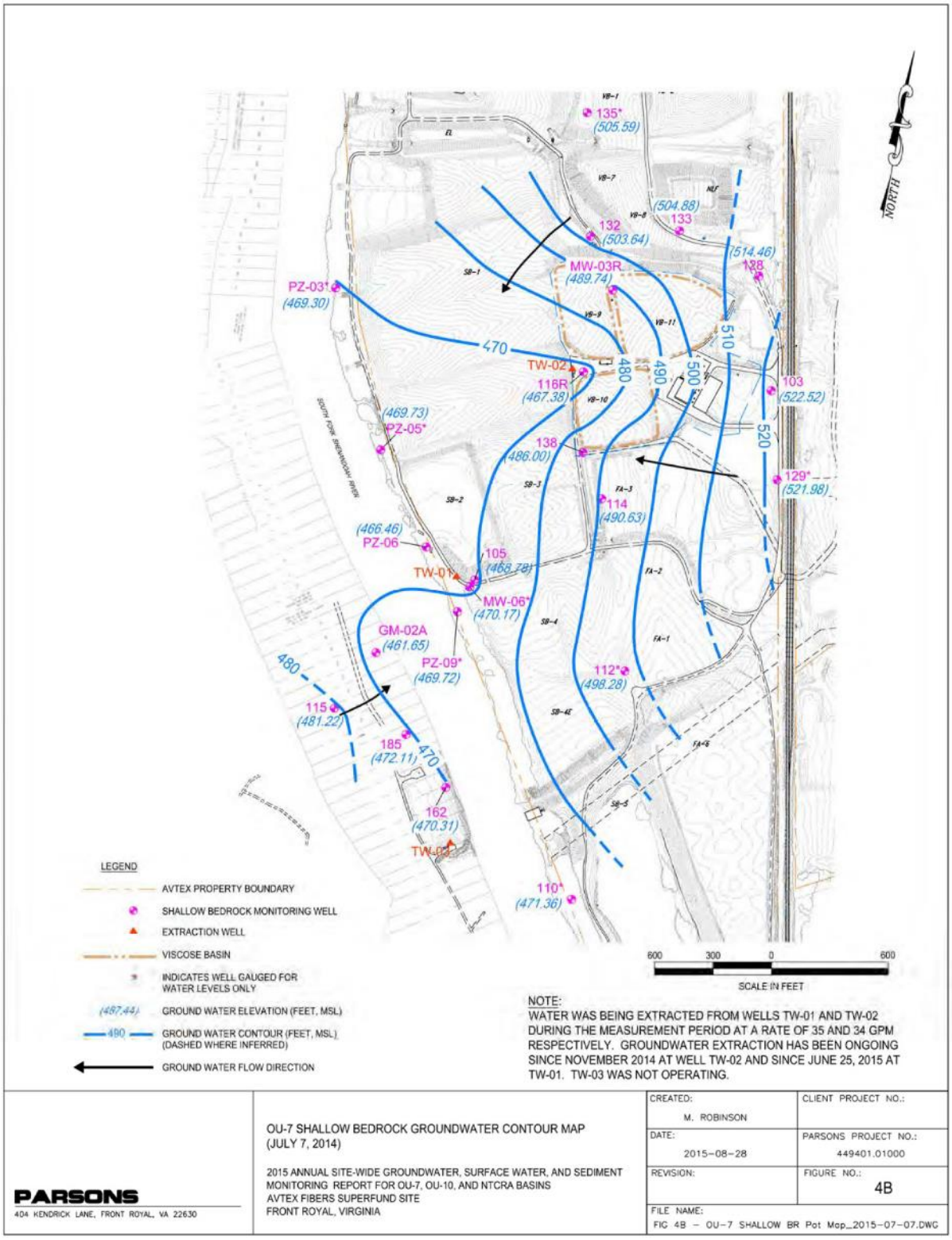


Figure H-9: OU7 Shallow Bedrock Groundwater Contour Map (September 2015)

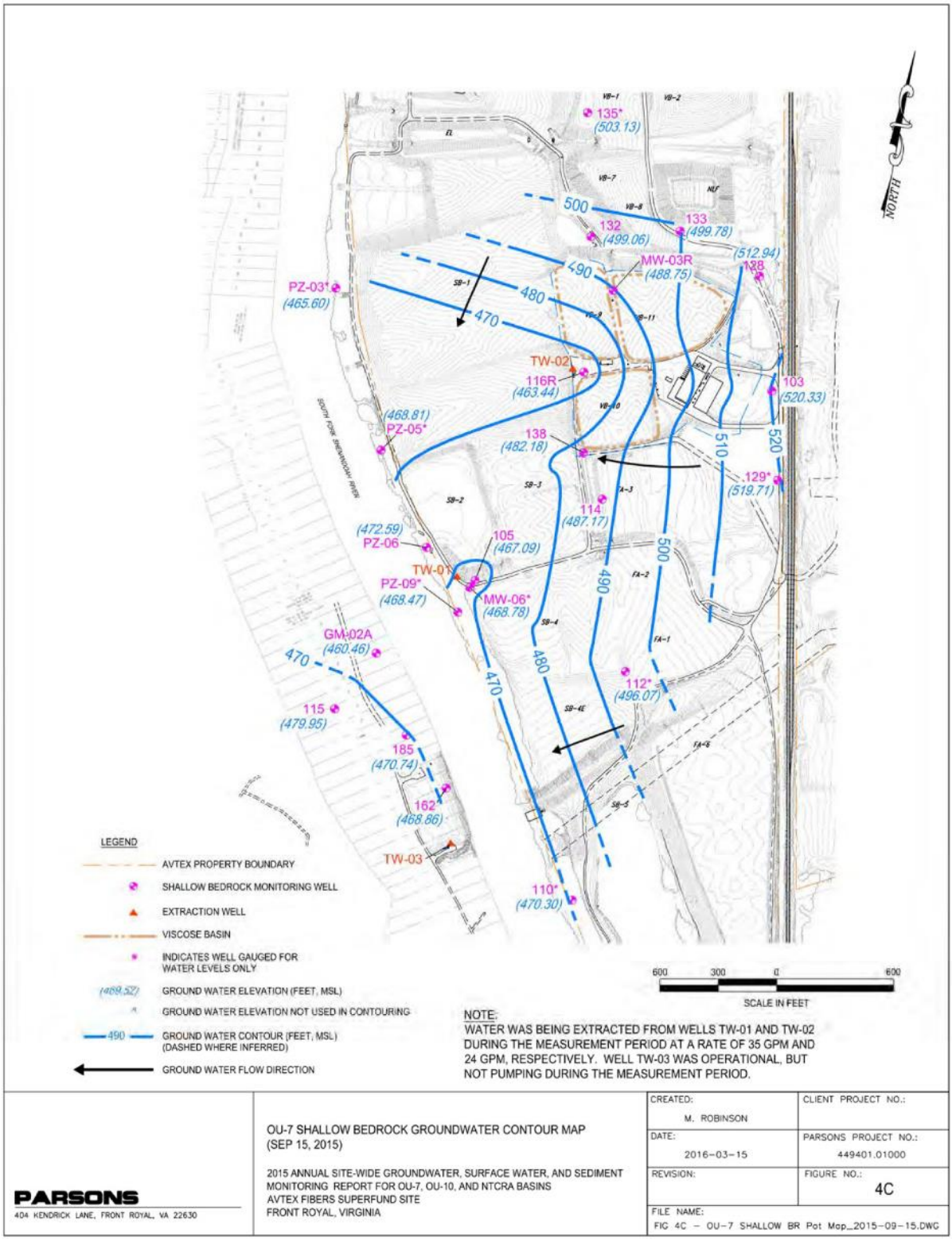


Figure H-10: OU7 Shallow Bedrock Groundwater Contour Map (December 2015)

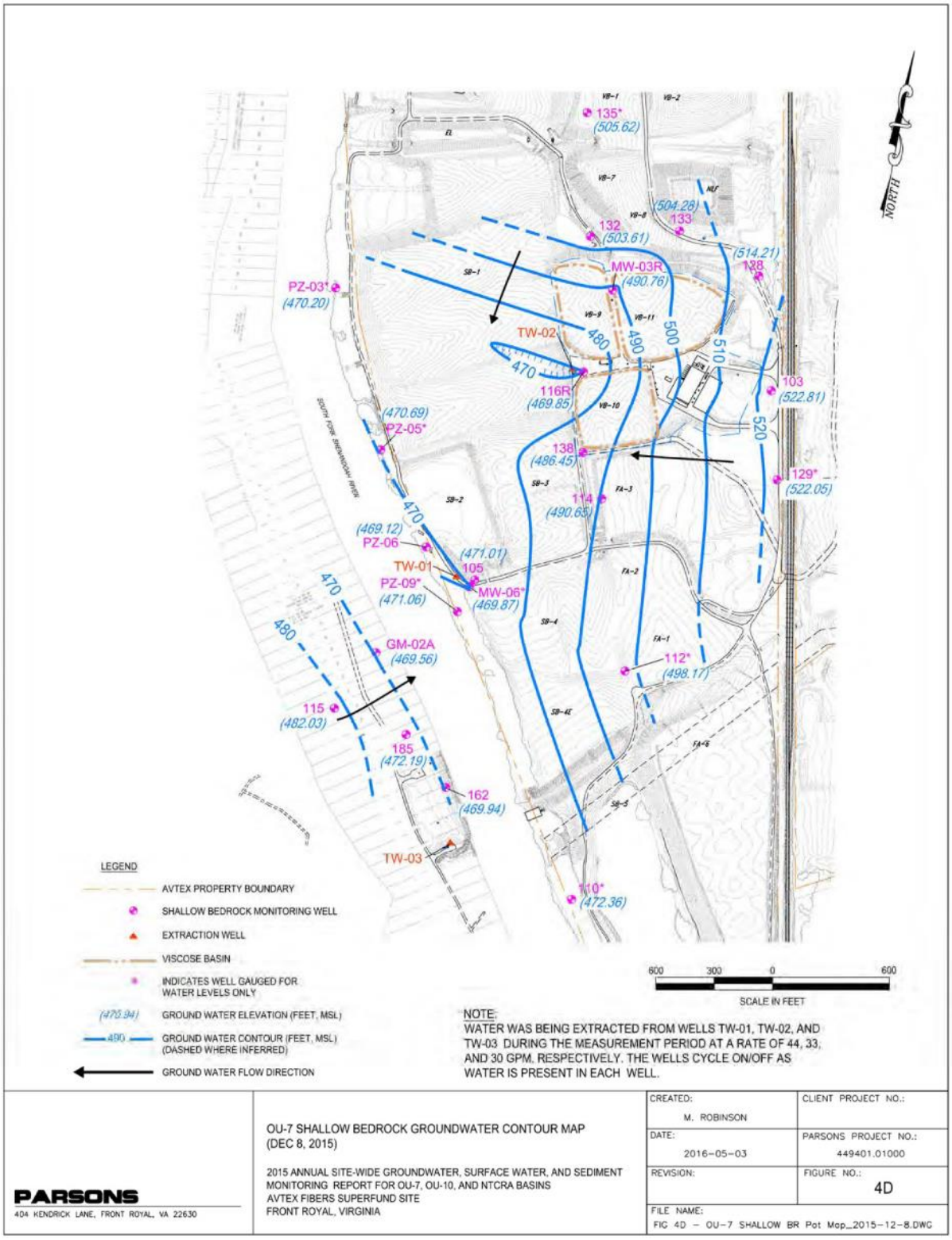


Figure H-11: OU7 Shallow Bedrock Groundwater Drawdown Map (September 2015)

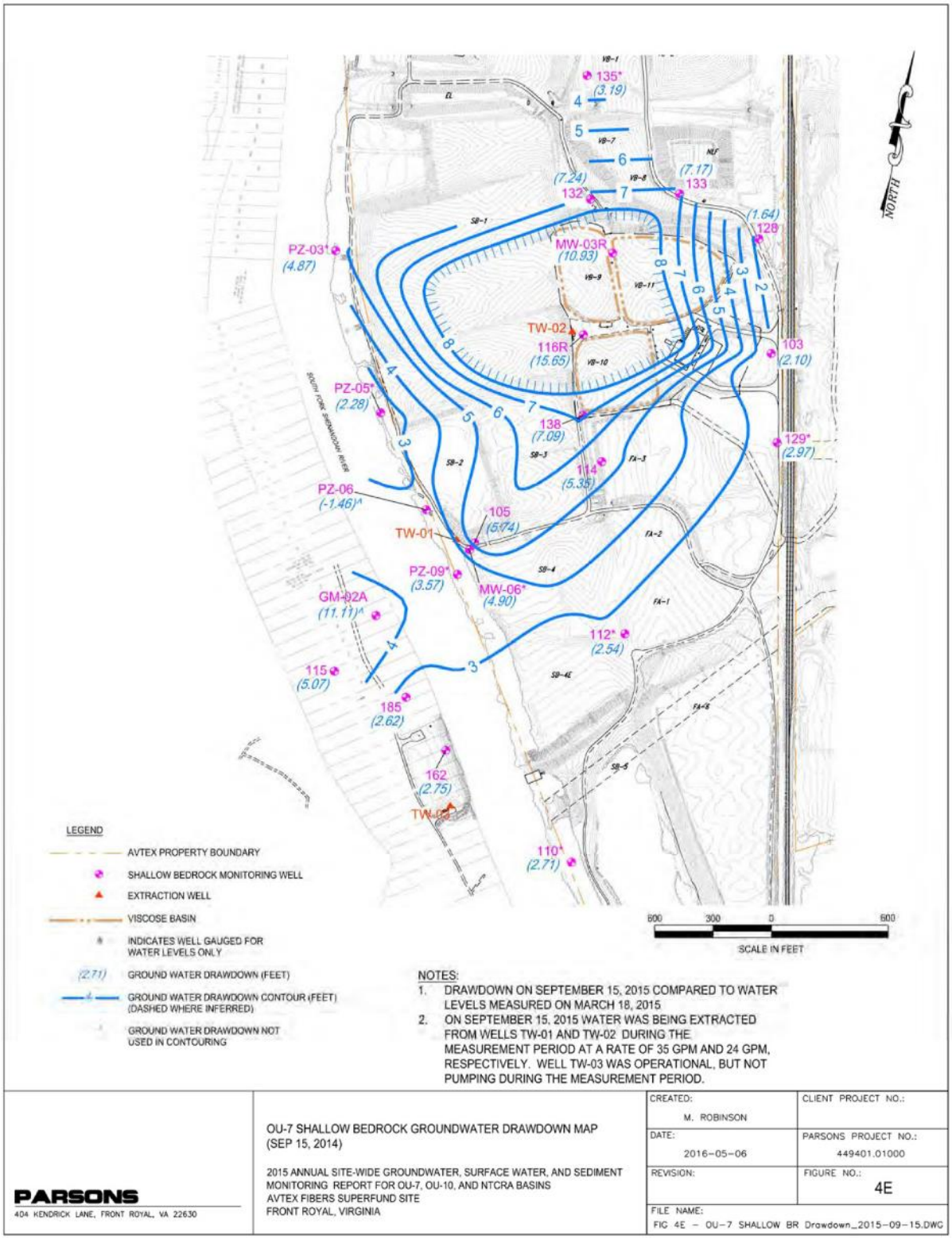


Figure H-12: OU7 Intermediate Bedrock Groundwater Contour Map (March 2015)

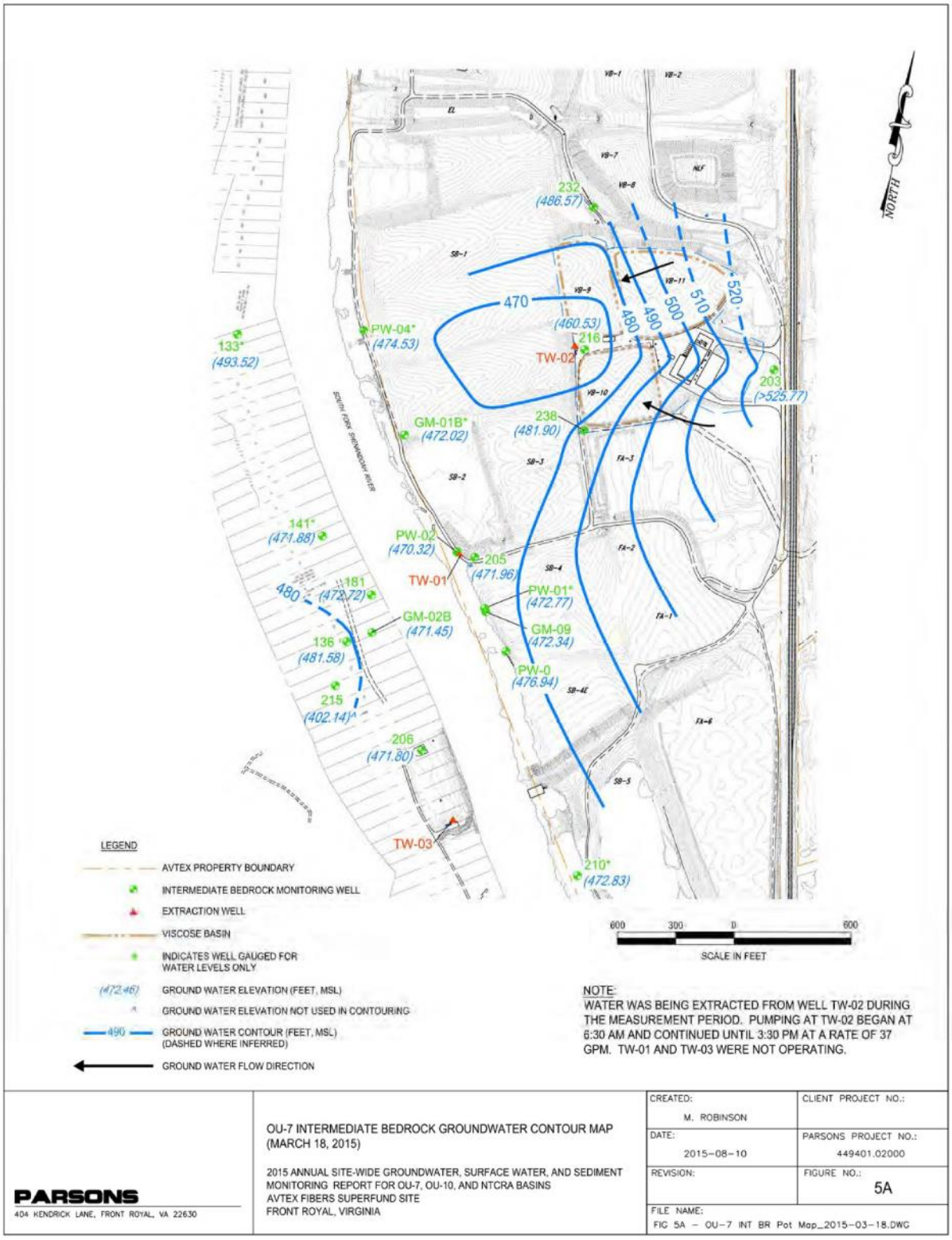


Figure H-13: OU7 Intermediate Bedrock Groundwater Contour Map (July 2015)

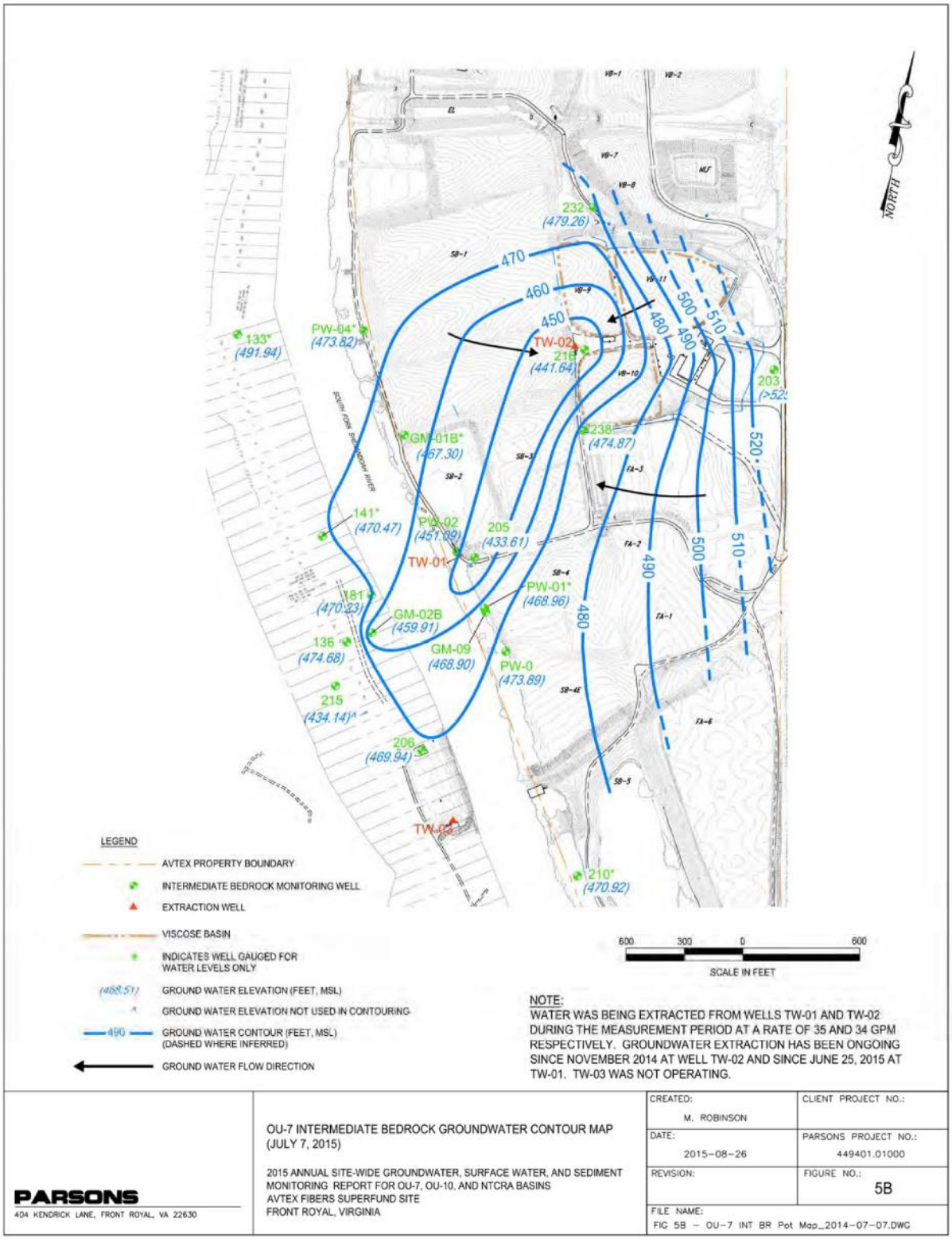


Figure H-14: OU7 Intermediate Bedrock Groundwater Contour Map (September 2015)

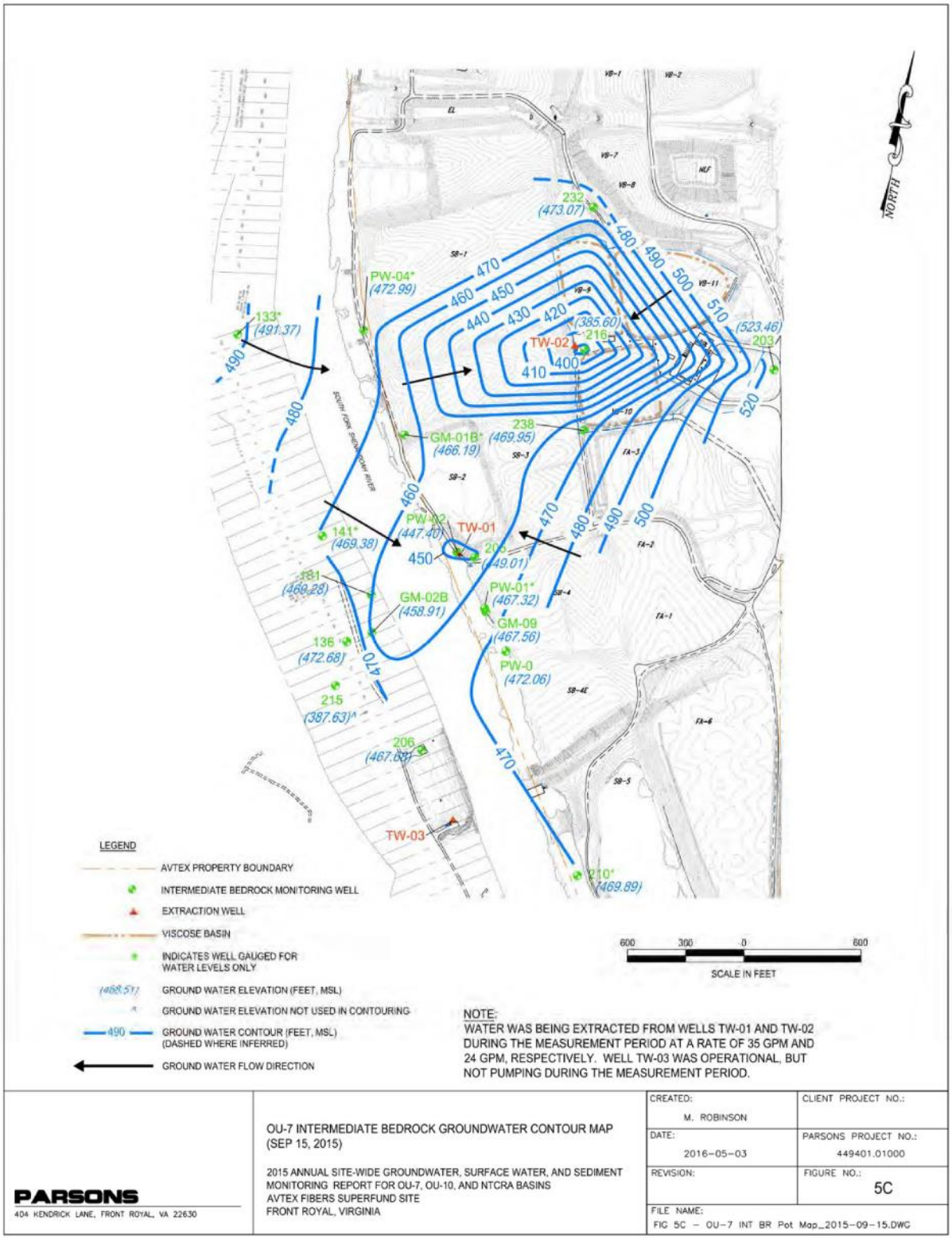


Figure H-15: OU7 Intermediate Bedrock Groundwater Contour Map (December 2015)

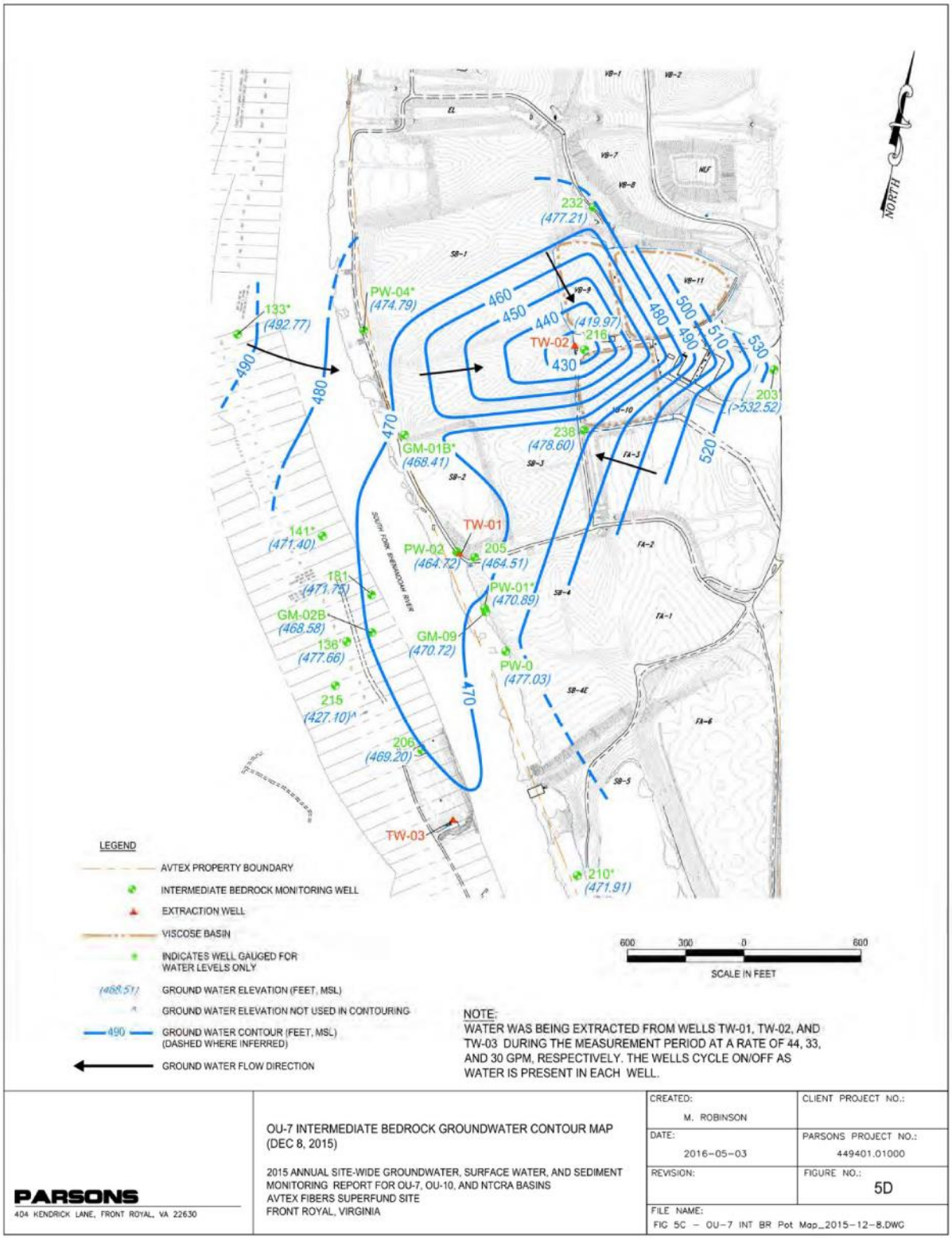


Figure H-16: OU7 Intermediate Bedrock Groundwater Drawdown Map (March 2015)

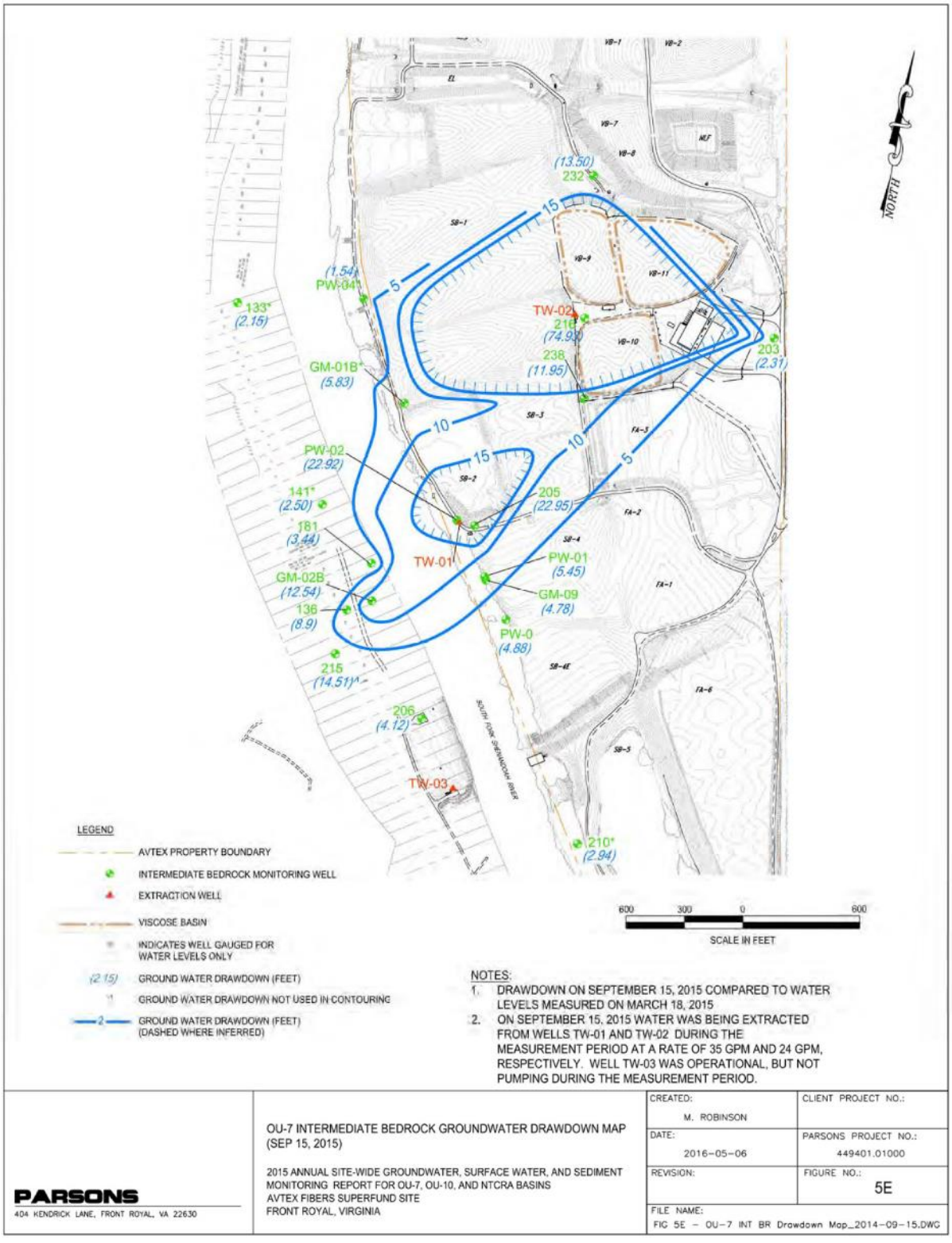


Figure H-17: OU7 Deep Bedrock Groundwater Contour Map (March 2015)

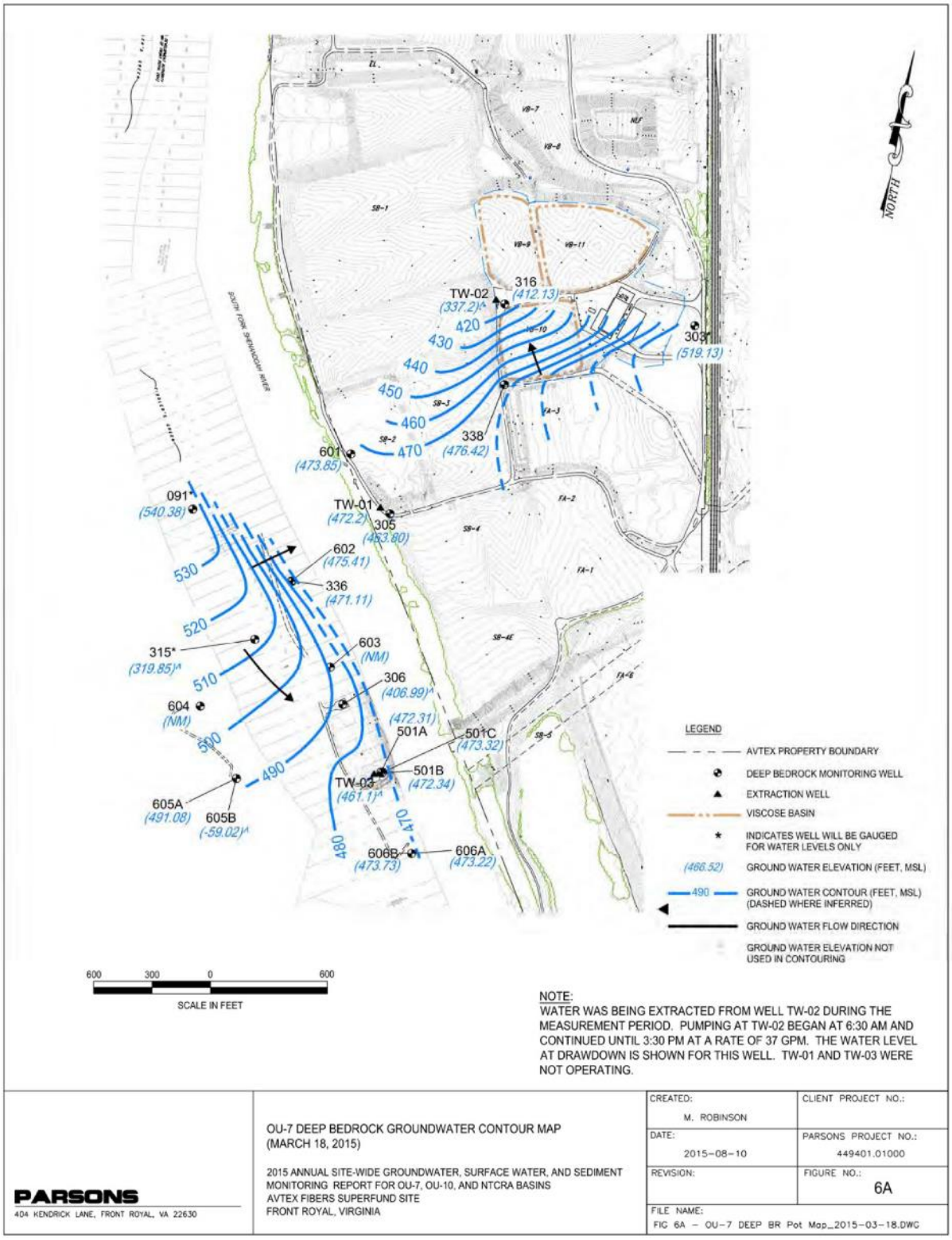


Figure H-18: OU7 Deep Bedrock Groundwater Contour Map (July 2015)

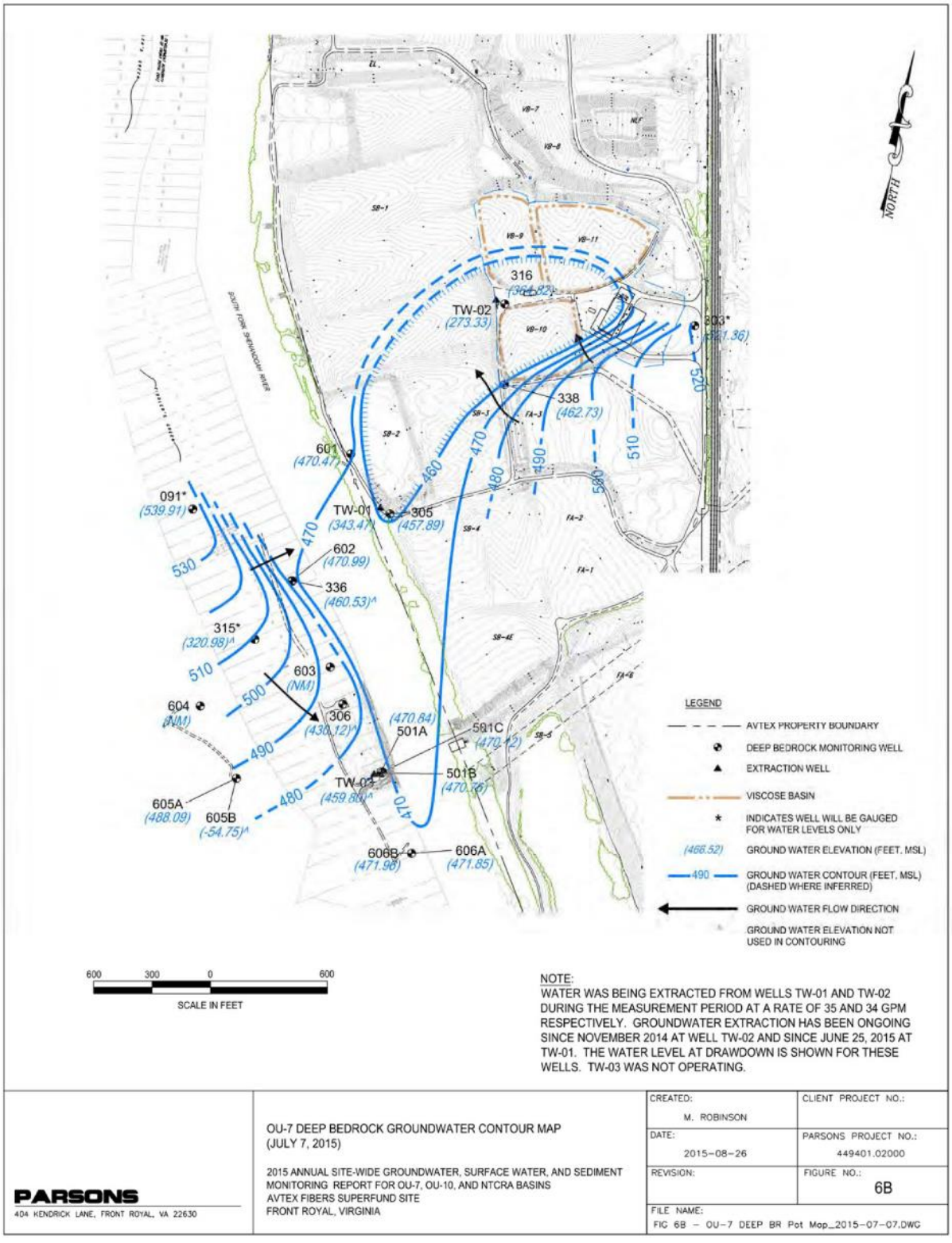


Figure H-19: OU7 Deep Bedrock Groundwater Contour Map (September 2015)

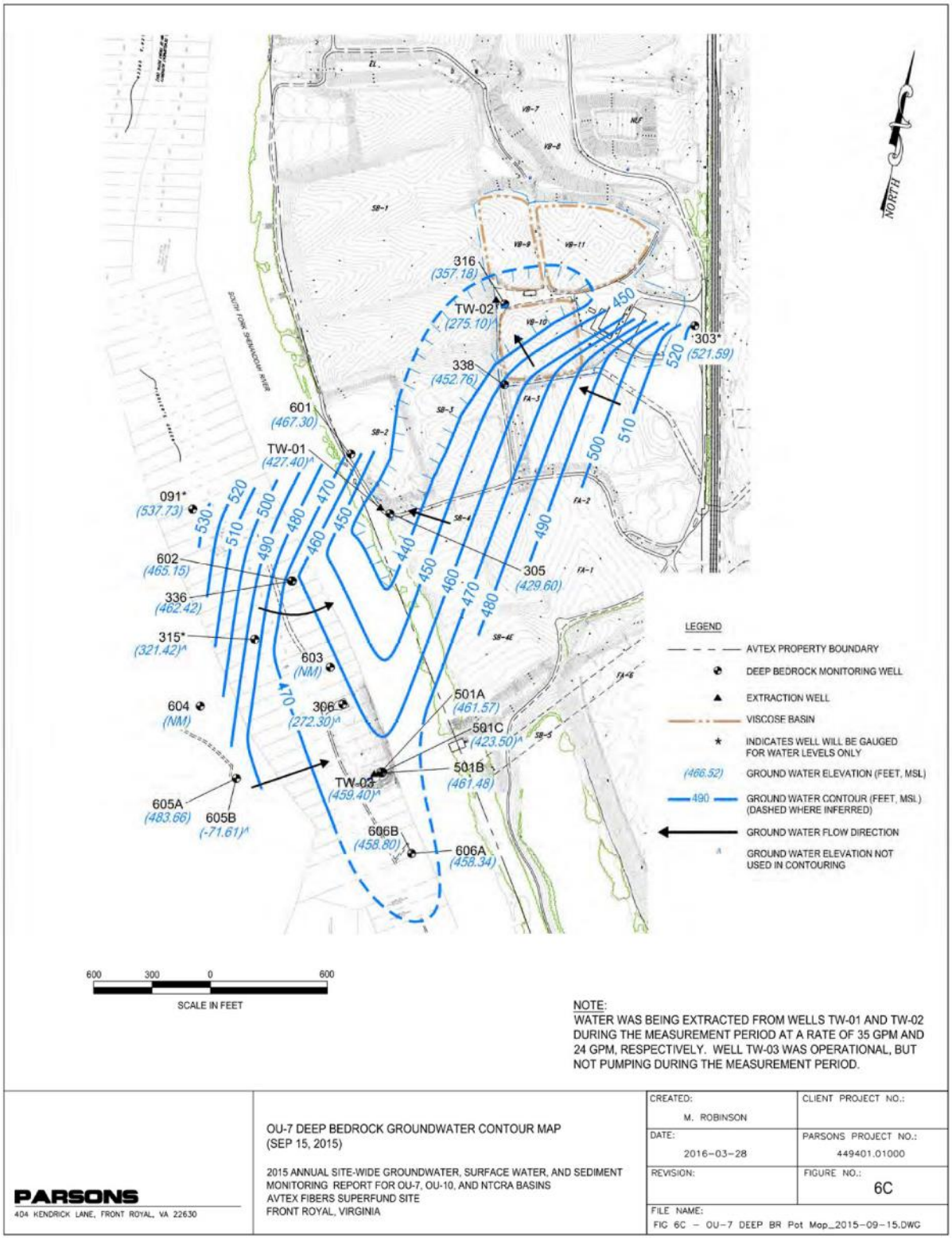


Figure H-20: OU7 Deep Bedrock Groundwater Contour Map (December 2015)

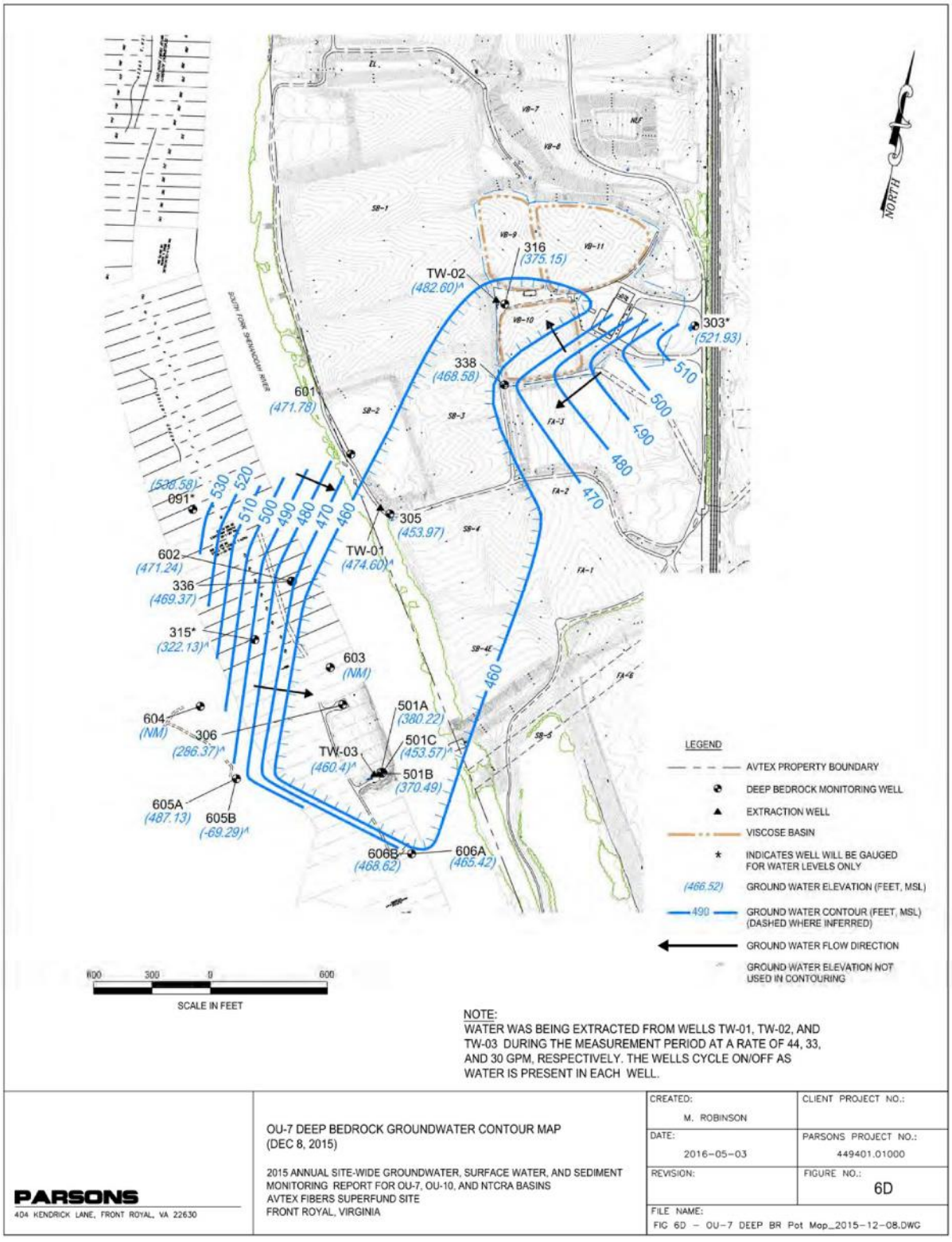


Figure H-21: OU7 Deep Bedrock Groundwater Drawdown Map (September 2015)

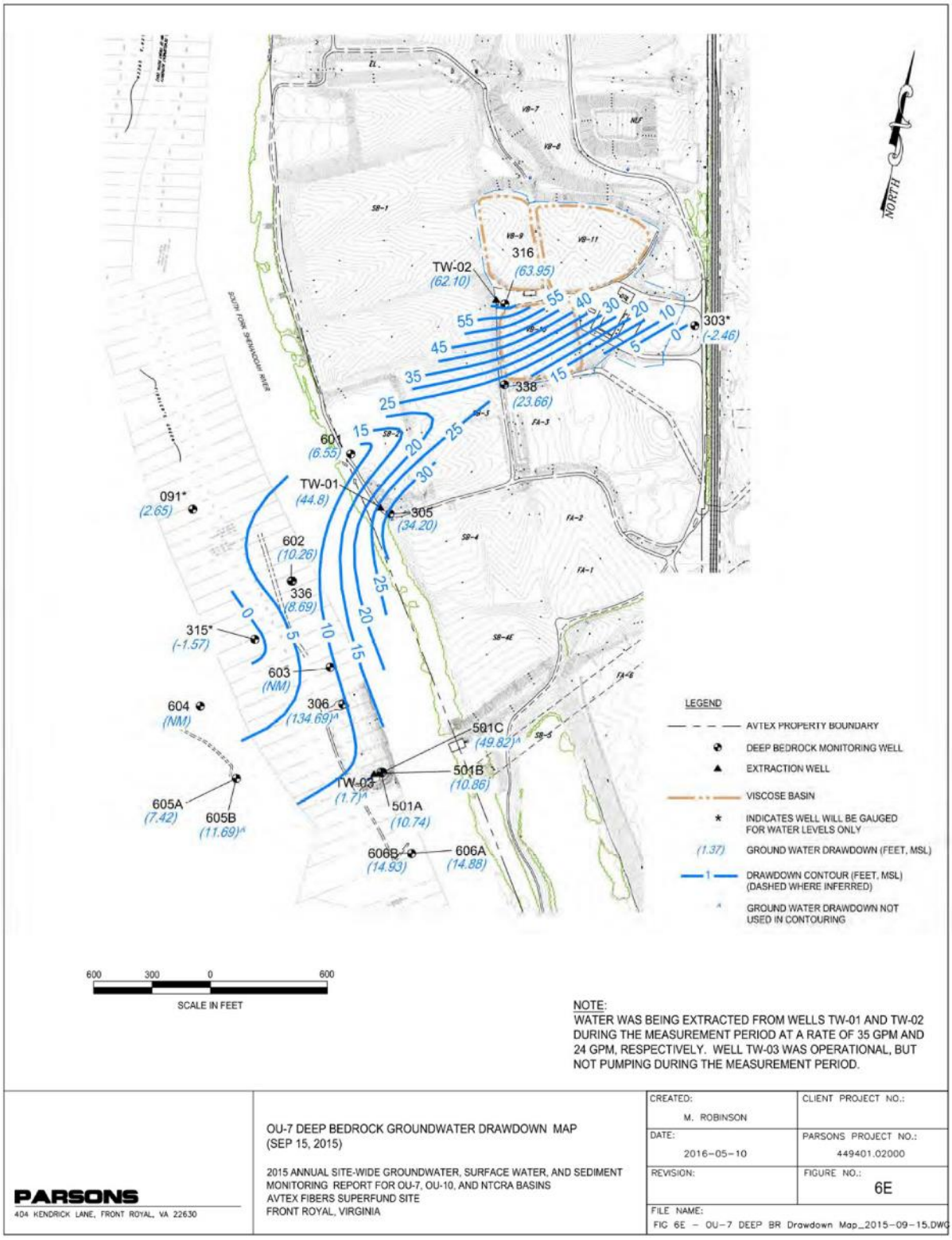


Figure H-22: Hydrogeologic Cross-Section A-A' (September 2015)

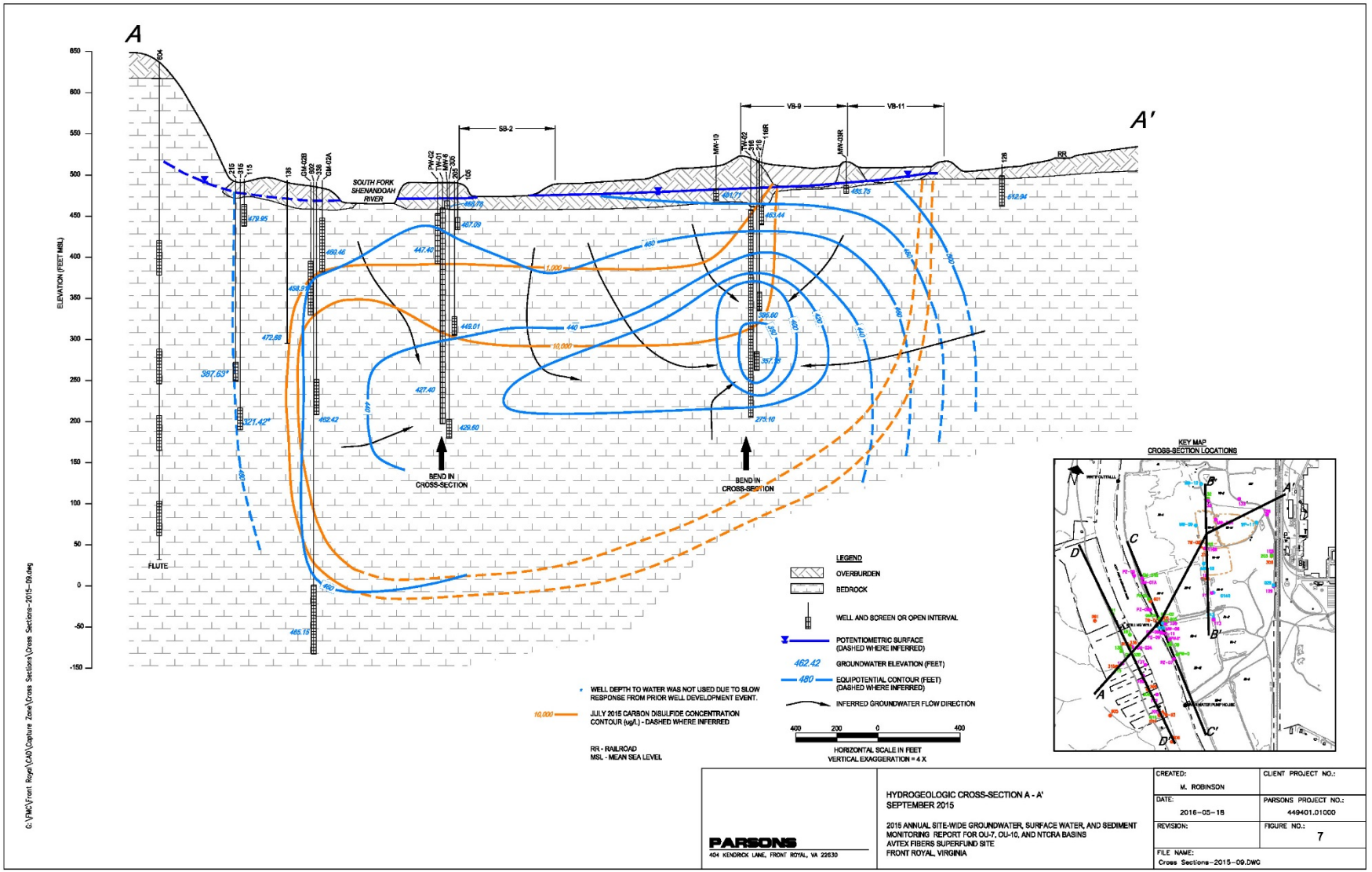


Figure H-23: Hydrogeologic Cross-Section B-B' (September 2015)

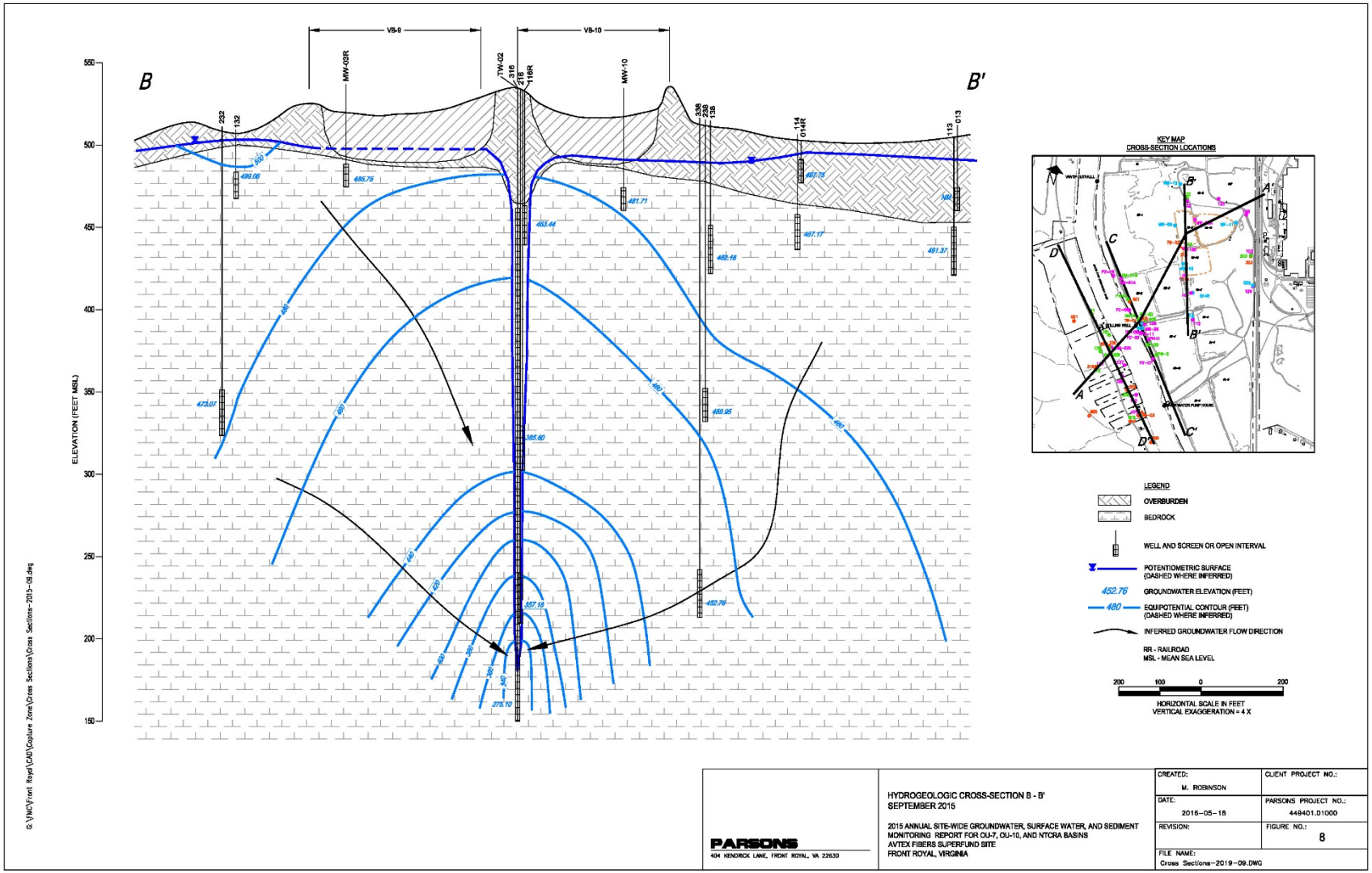


Figure H-24: Hydrogeologic Cross-Section C-C' (September 2015)

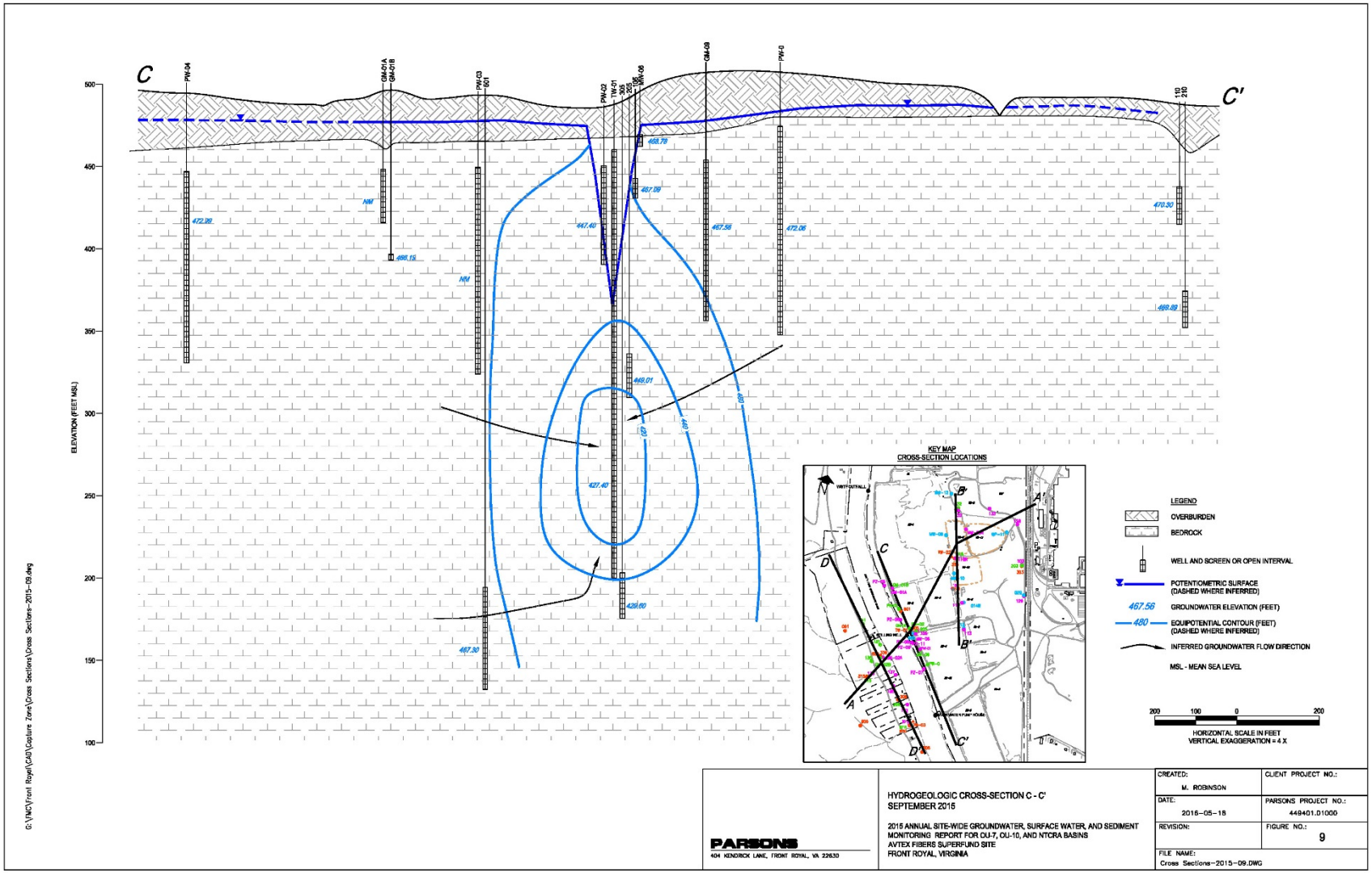


Figure H-25: Hydrogeologic Cross-Section D-D' (September 2015)

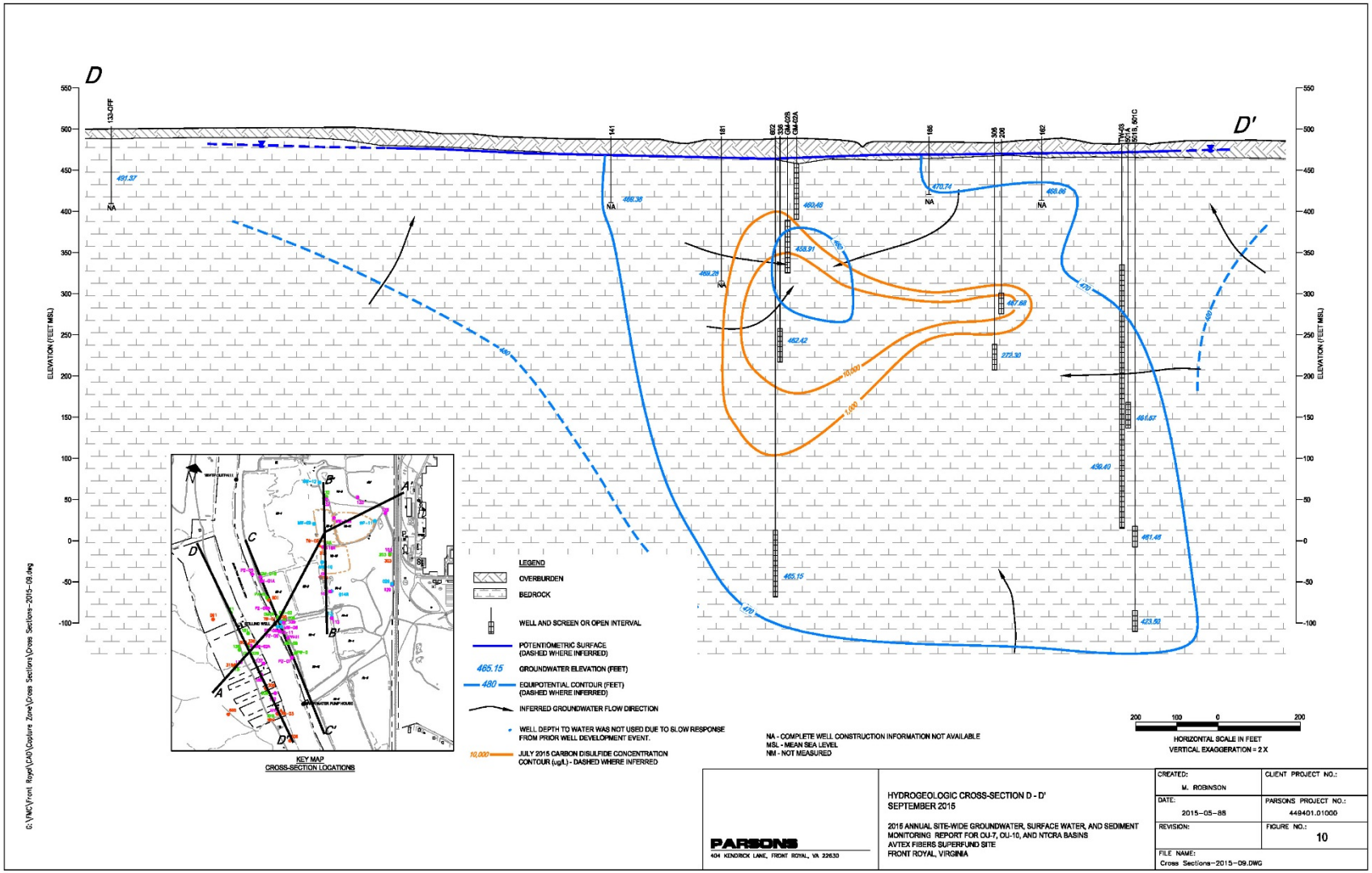


Figure H-26: OU7 Overburden Groundwater Isoconcentration Contour Map (July 2015)

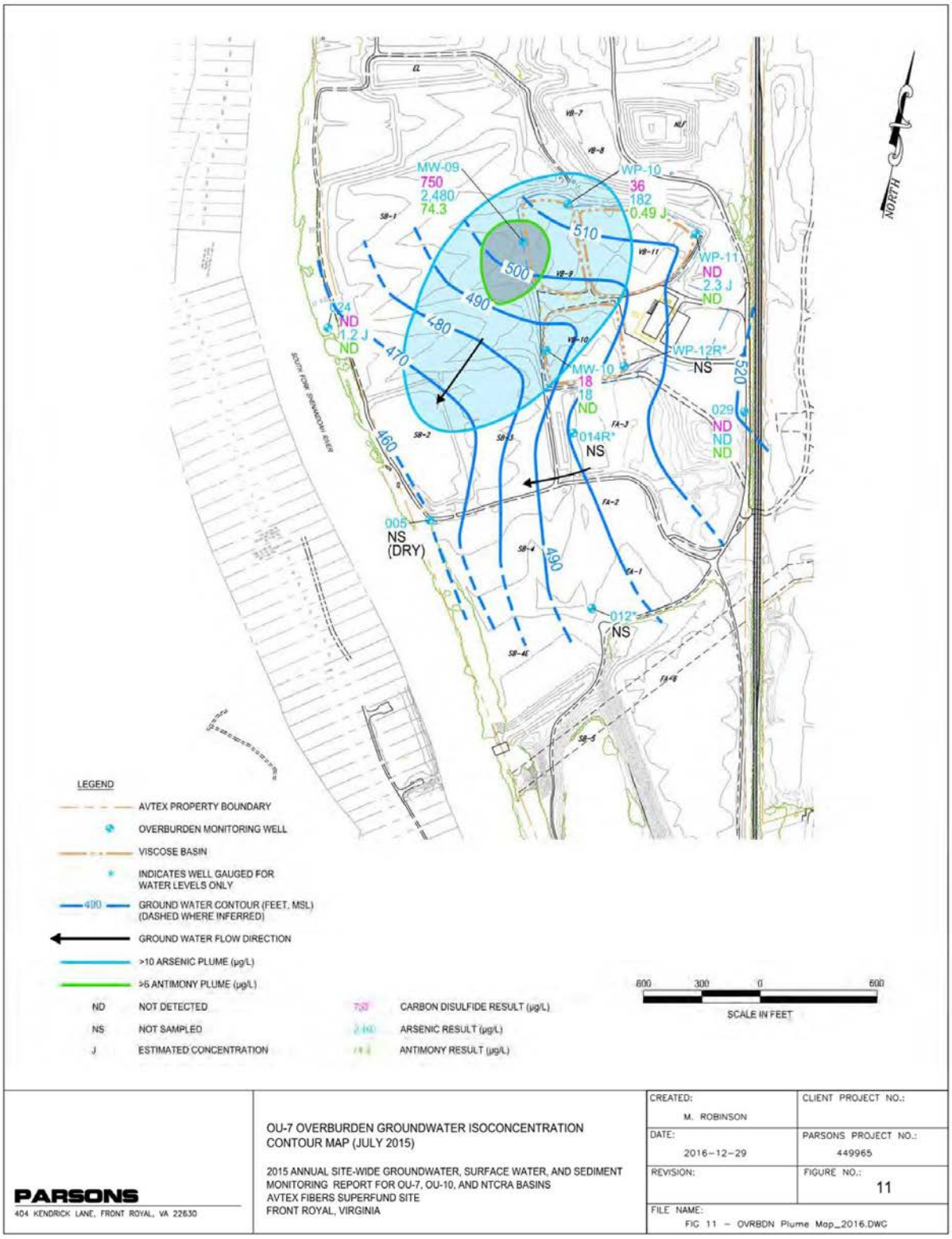


Figure H-27: OU7 Shallow Bedrock Groundwater Isoconcentration Contour Map (July 2015)

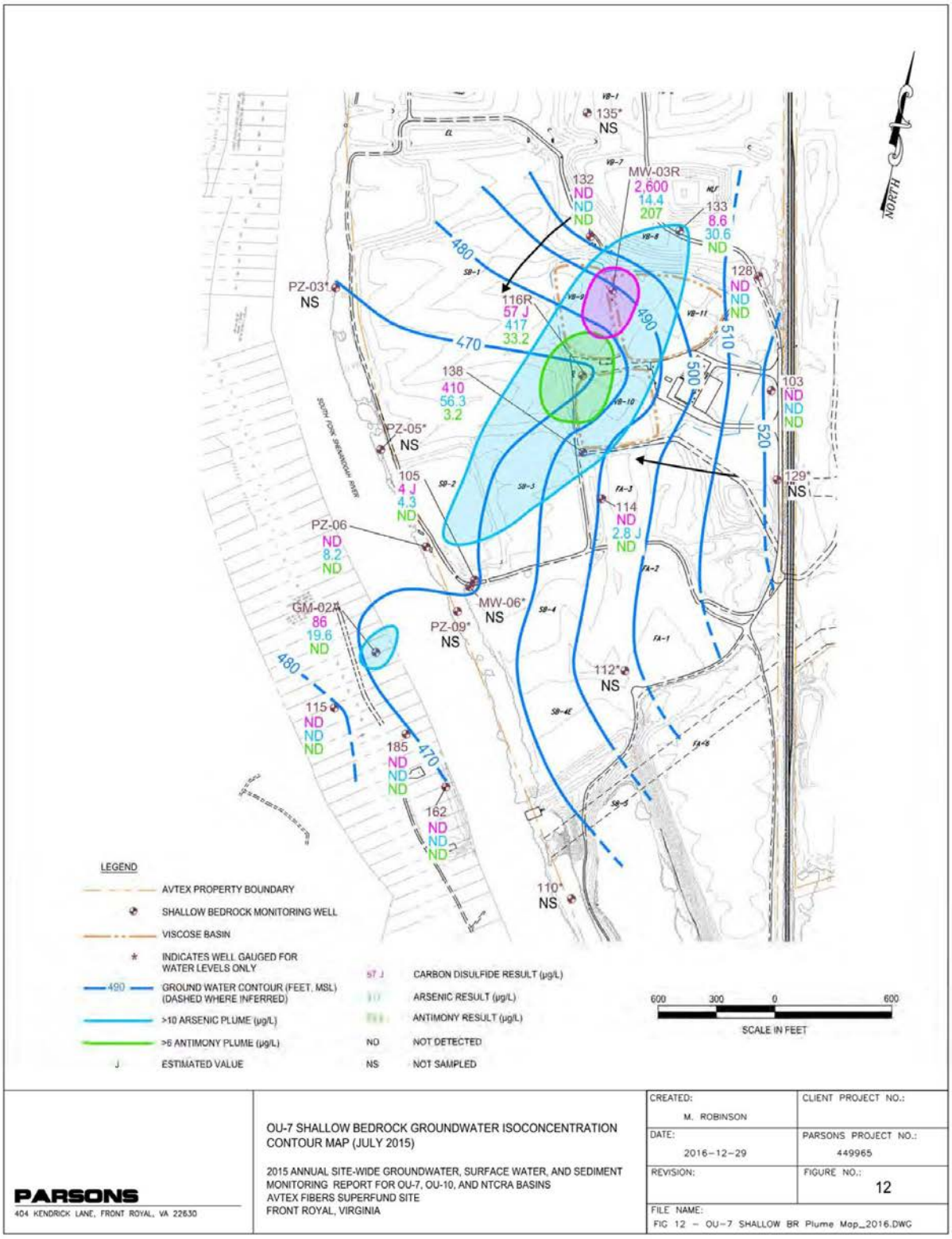
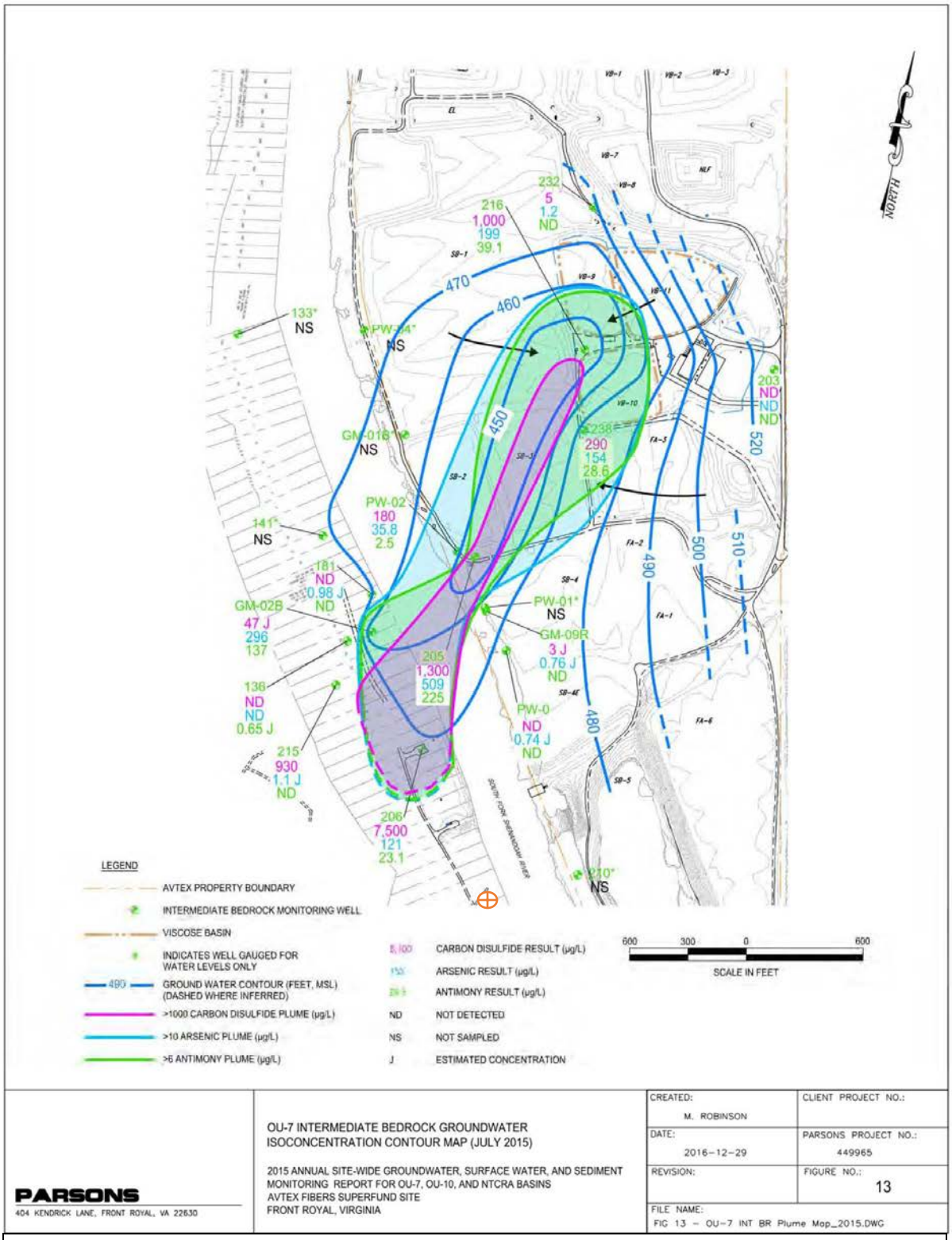


Figure H-28: OU7 Intermediate Bedrock Groundwater Isoconcentration Contour Map (July 2015)



Carbon disulfide was not detected in the Borehole 606 ⊕ (south of TW-03) intermediate groundwater packer interval in a 2013 TW-03 investigation suggesting that the extent of the plume does not impact south of this point.

Figure H-29: OU7 Deep Bedrock Groundwater Isoconcentration Contour Map (July 2015)

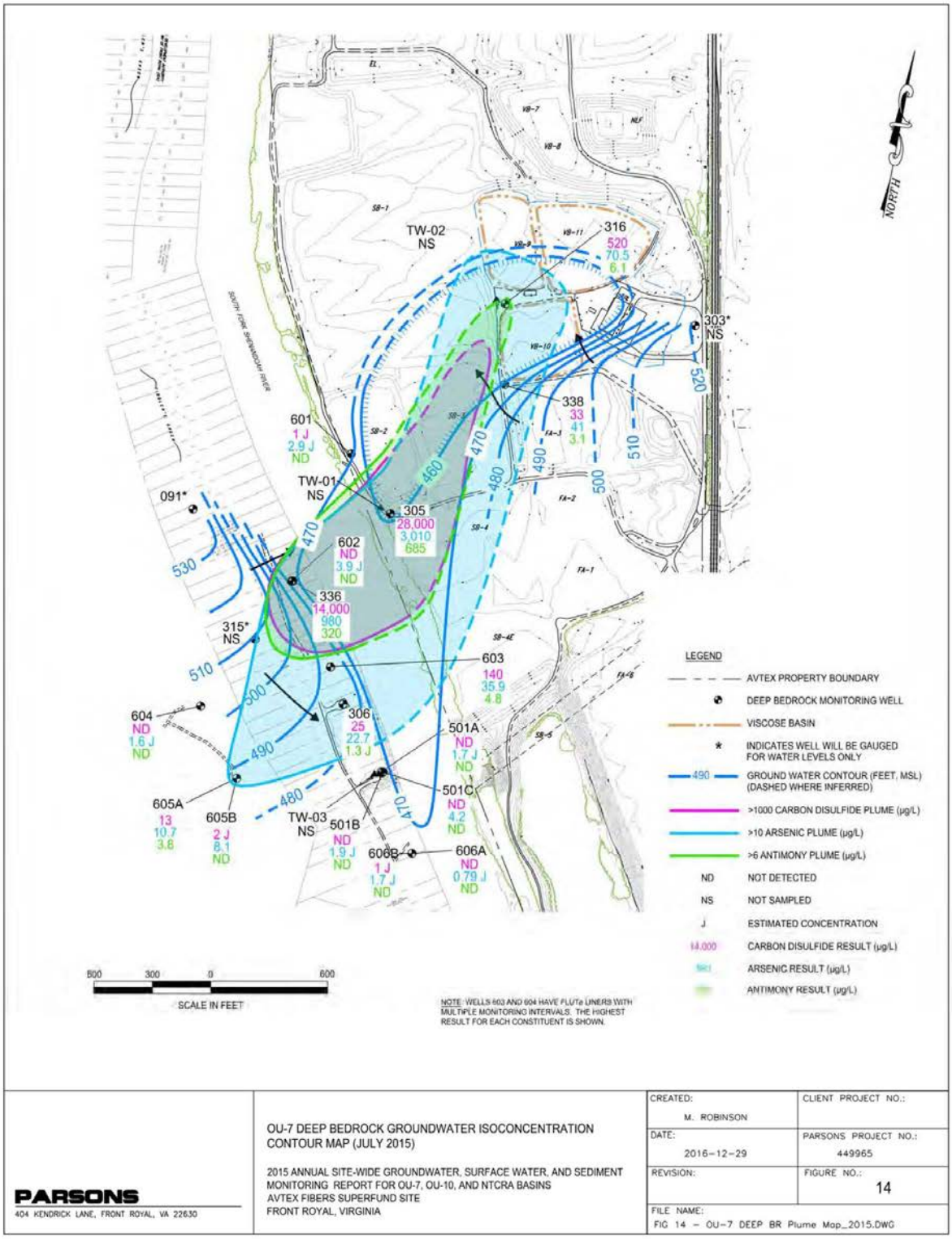


Figure H-30: OU7 VSMWR Monitoring Network
Source: 2015 Annual Report

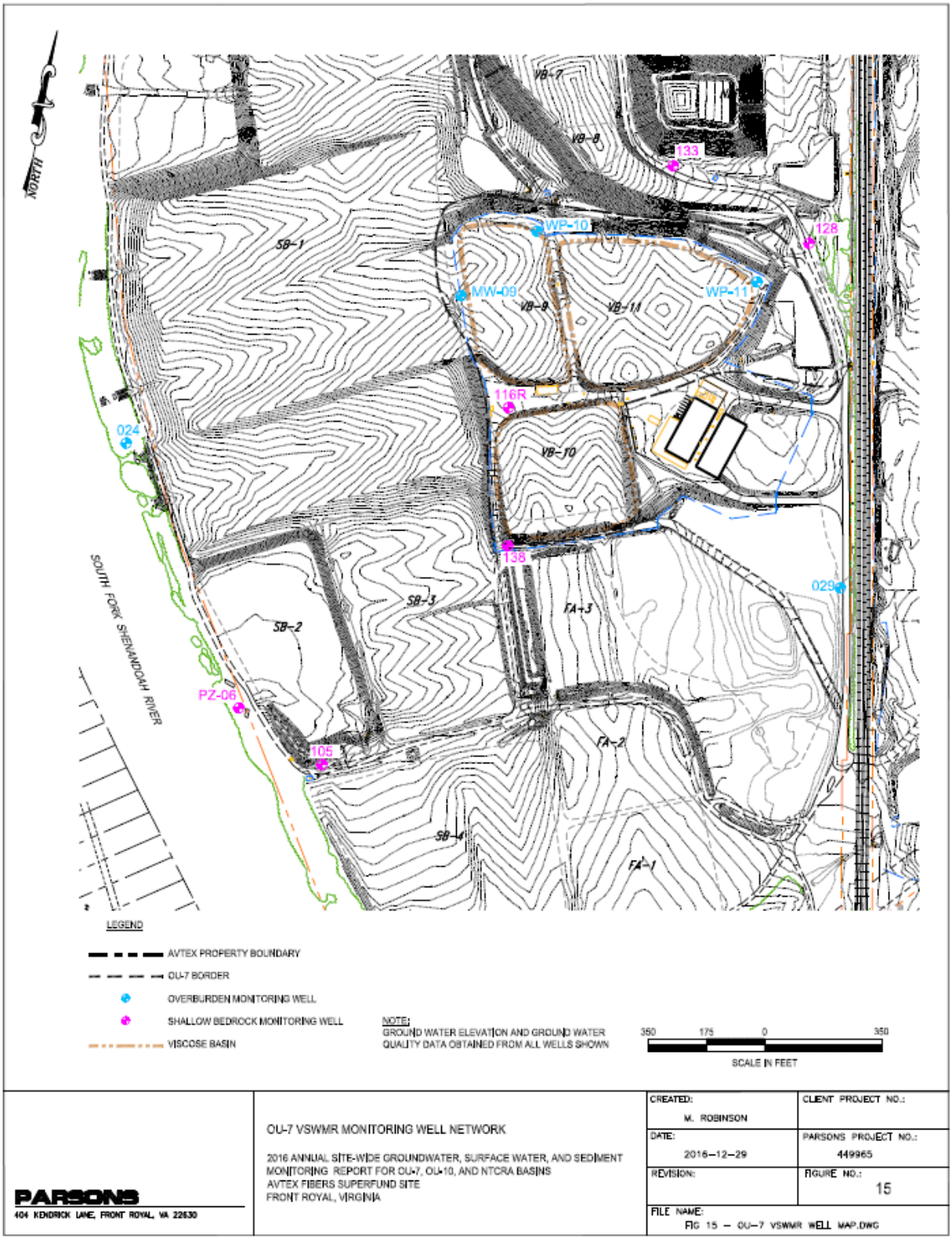


Figure H-31: OU7 River Water and Sediment Sampling Locations
Source: 2015 Annual Report

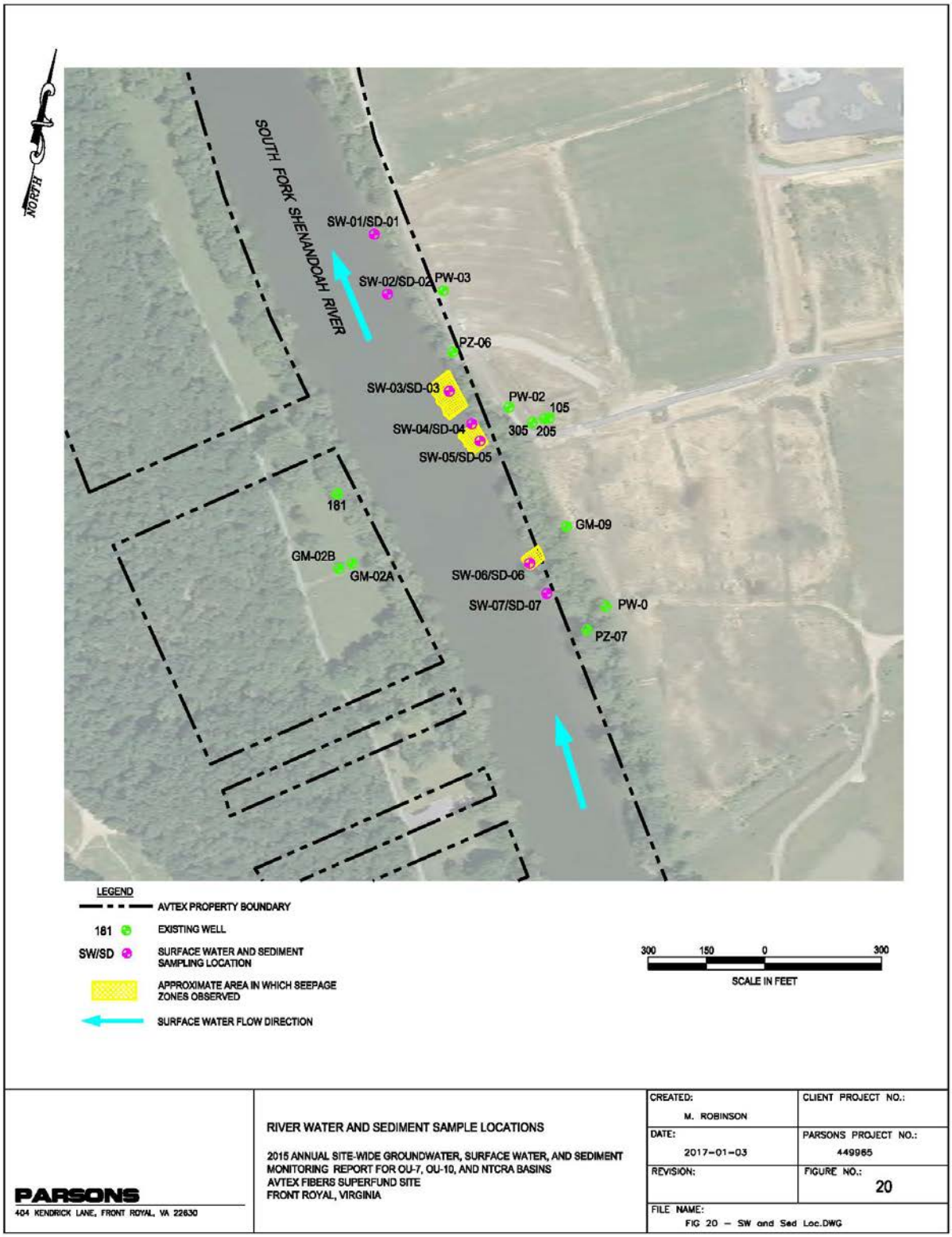


Figure H-32: OU7 Aquatic Biota Sampling Locations
Source: 2015 Annual Report

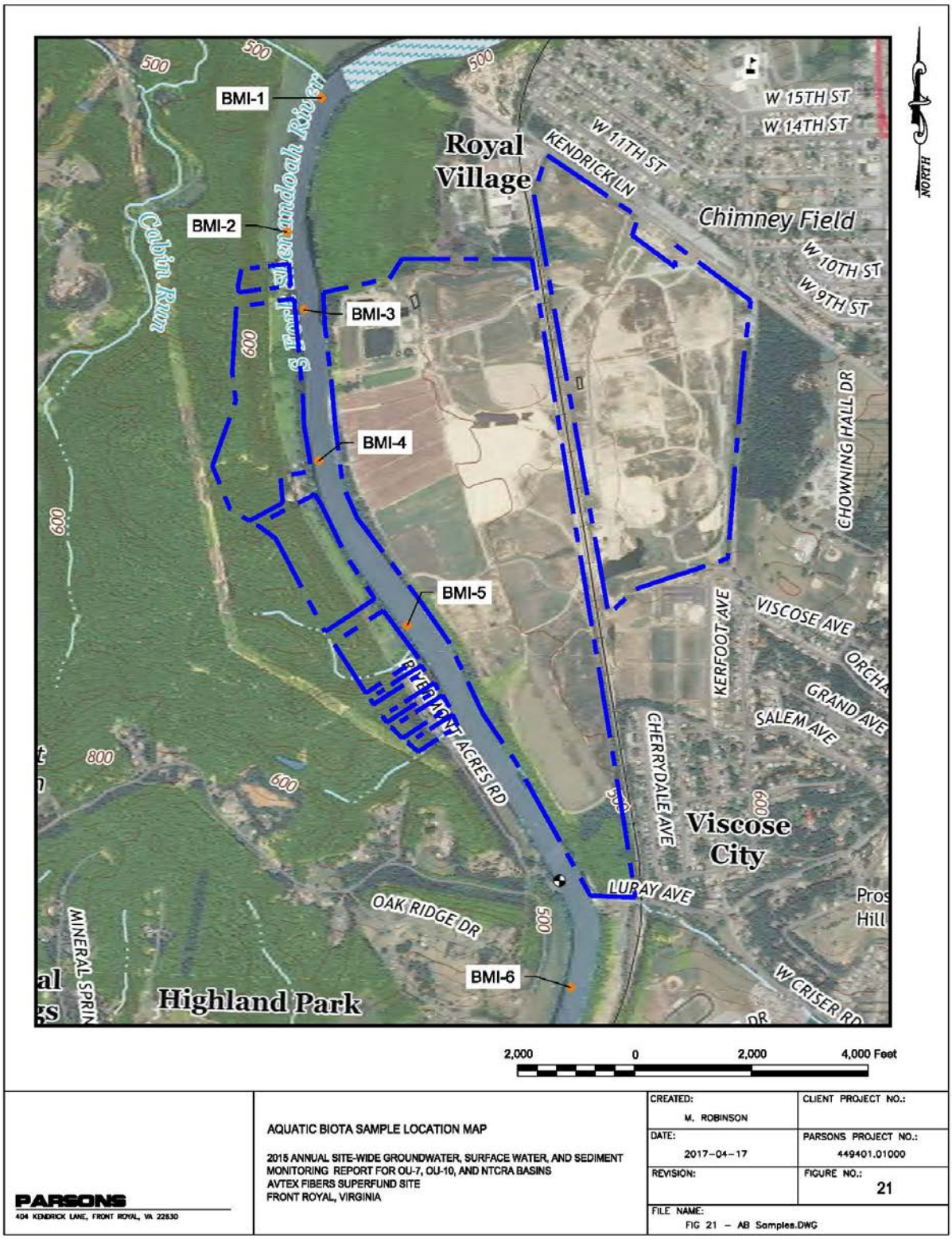
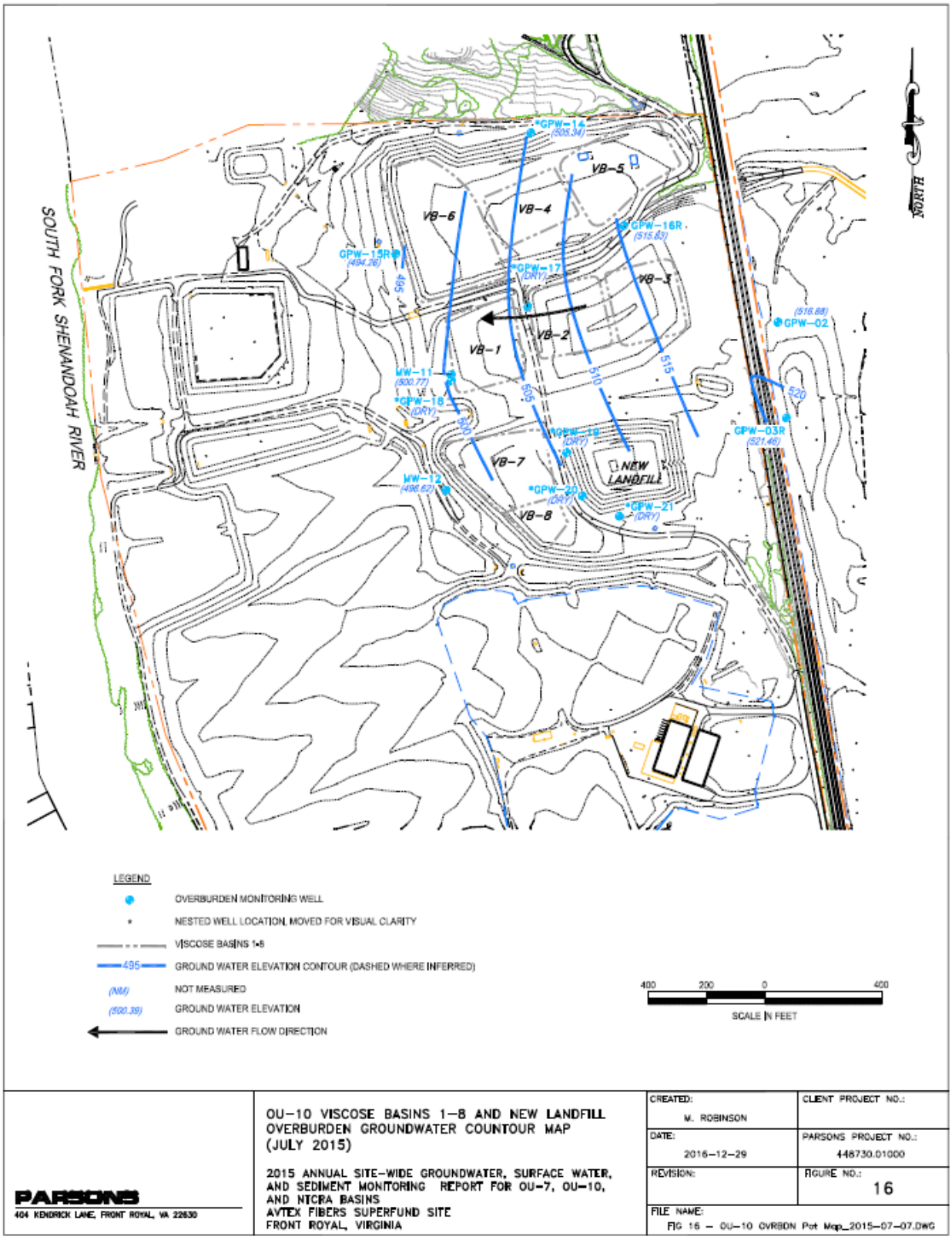


Figure H-33: OU10 Overburden Groundwater Contour Map (July 2015)
Source: 2015 Annual Report



PARSONS 404 KENDRICK LANE, FRONT ROYAL, VA 22630	OU-10 VISCOSE BASINS 1-8 AND NEW LANDFILL OVERBURDEN GROUNDWATER COUNTOUR MAP (JULY 2015) 2015 ANNUAL SITE-WIDE GROUNDWATER, SURFACE WATER, AND SEDIMENT MONITORING REPORT FOR OU-7, OU-10, AND NTCRA BASINS AVTEX FIBERS SUPERFUND SITE FRONT ROYAL, VIRGINIA	CREATED: M. ROBINSON DATE: 2016-12-29 REVISION:	CLIENT PROJECT NO.: PARSONS PROJECT NO.: 448730.01000 FIGURE NO.: 16
		FILE NAME: FIG 16 - OU-10 OVRBDN Pot Map_2015-07-07.DWG	

Figure H-34: OU10 Shallow Bedrock Groundwater Contour Map (July 2015)
Source: 2015 Annual Report

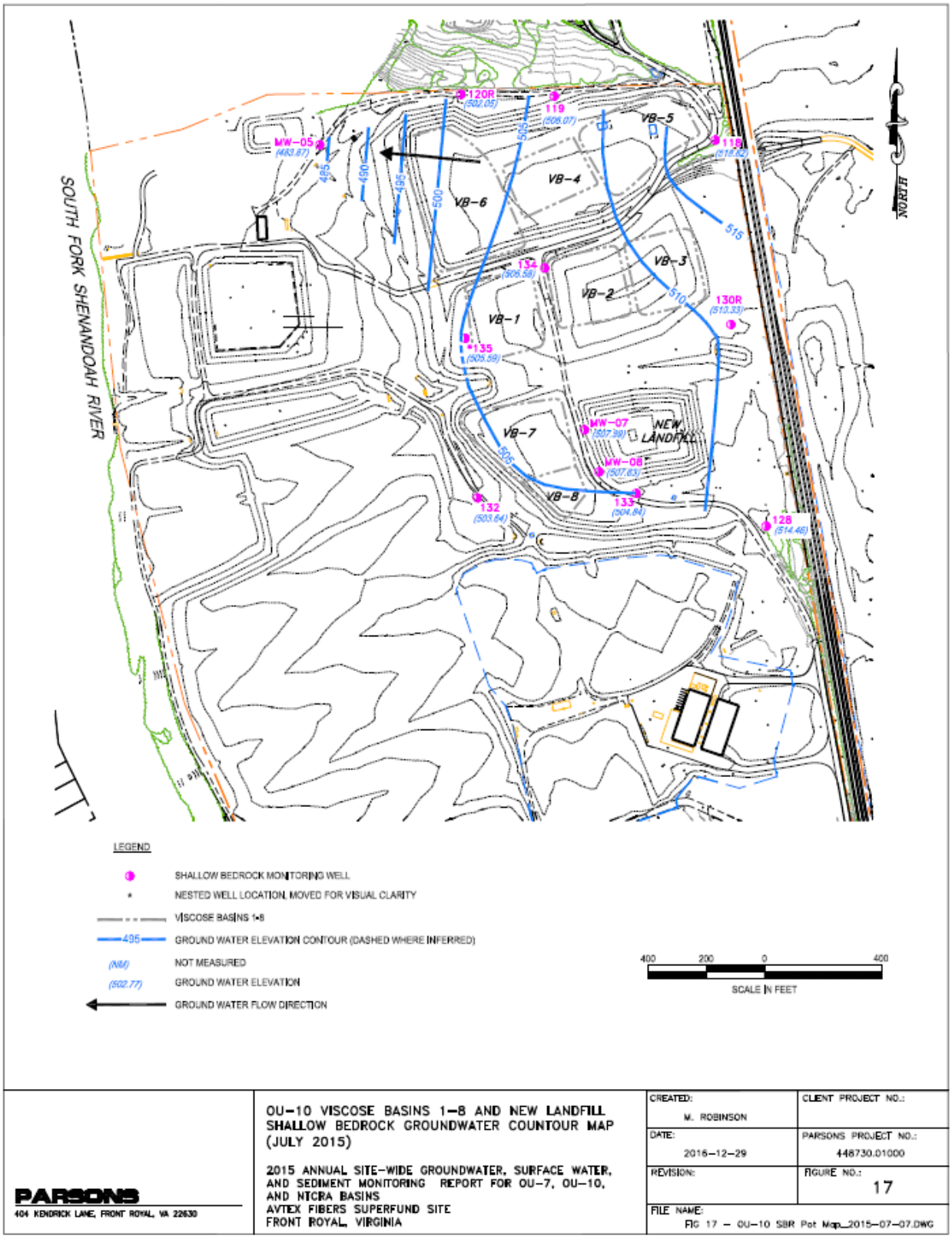


Figure H-35: NTCRA Basins Overburden Groundwater Contour Map (July 2015)
Source: 2015 Annual Report

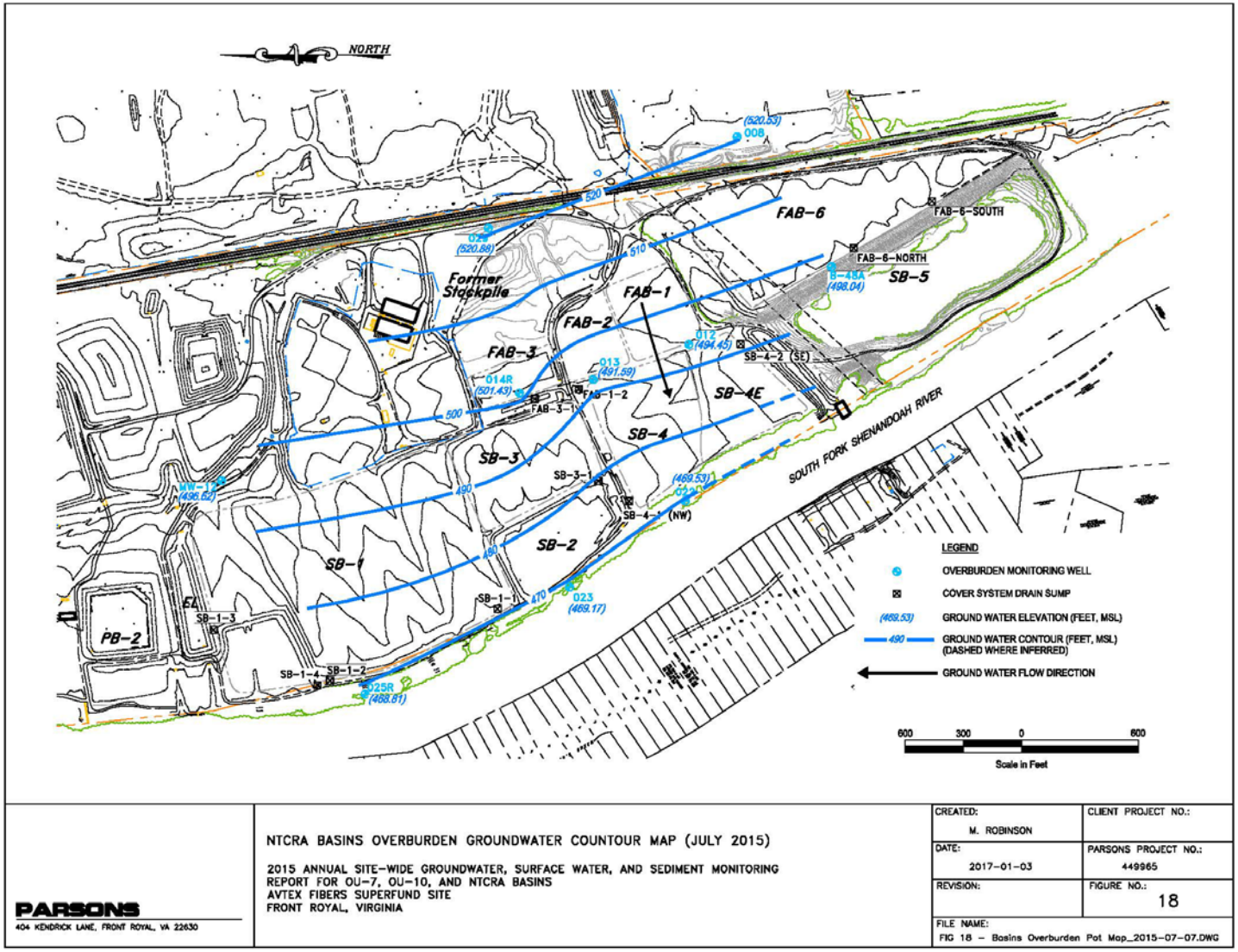


Figure H-36: NTCRA Basins Shallow Bedrock Groundwater Contour Map (July 2015)
Source: 2015 Annual Report

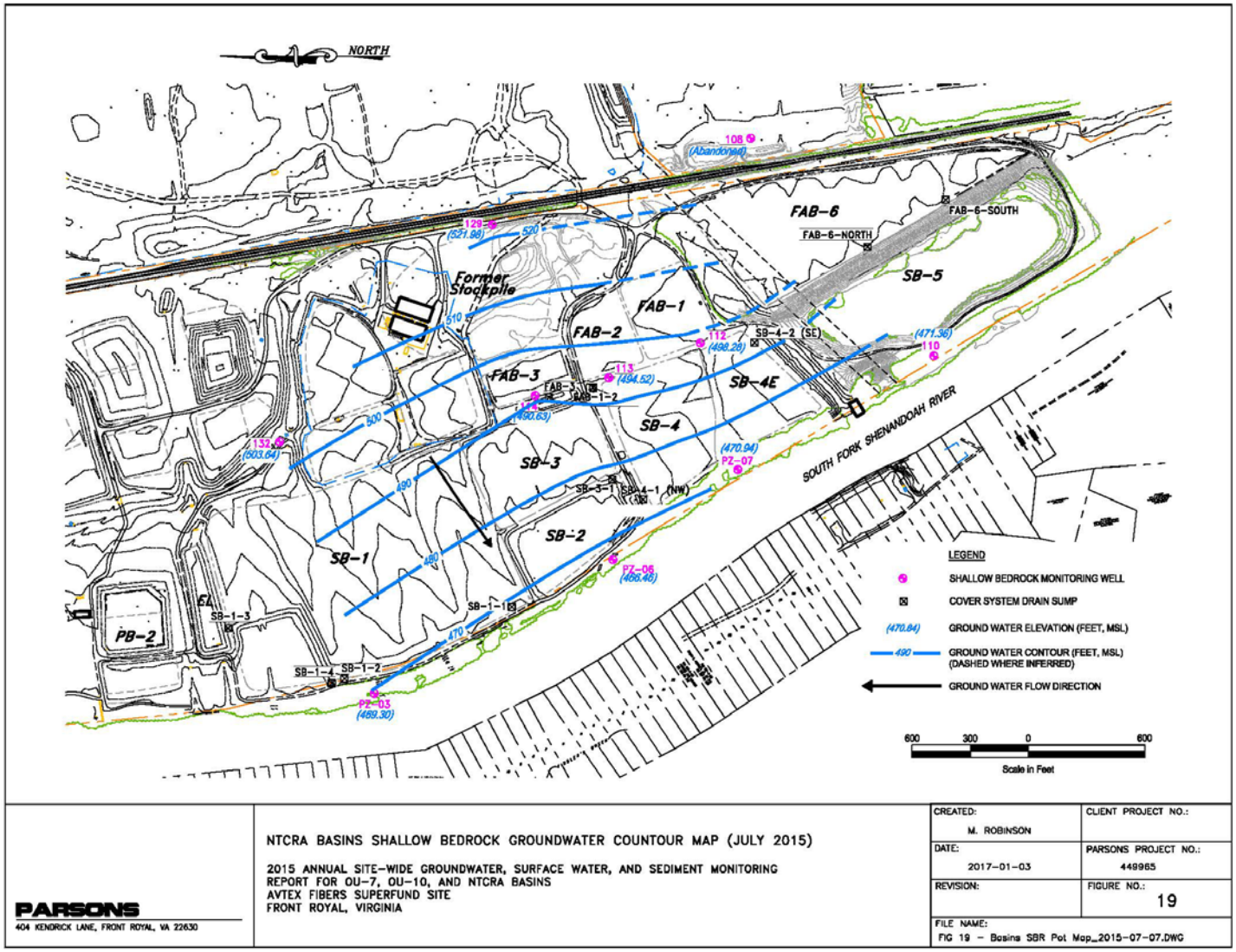


Table H-5: OU7 Groundwater Analytical Results – 2015

Source: 2015 Annual Report

TABLE 9

OU-7 Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		024 7963078 OMW AVX01 7/8/2015 8:49 11/26/2015	029 7981290 OMW AVX11 7/26/2015 12:45 11/26/2015	103 7981291 S BMW AVX11 7/26/2015 14:35 11/26/2015	105 7984571 S BMW AVX15 7/28/2015 9:45 11/26/2015	114 7993583 S BMW AVX16 8/5/2015 11:30 11/26/2015	115 7964621 S BMW AVX02 7/12/2015 14:31 11/26/2015	116R 7964622 S BMW AVX02 7/12/2015 9:30 11/26/2015	128 7968057 S BMW AVX05 7/14/2015 17:41 11/26/2015	132 7981293 S BMW AVX11 7/24/2015 14:40 11/26/2015	132 (DUP) 7981297 S BMW AVX11 7/24/2015 14:40 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	20 U	20 U	20 U	20 U	20 U	20 U	400 U	5 U	5 U	5 U
75-15-0	Carbon Disulfide	ug/L	1000	RBC	5 U	5 U	5 U	**4 J**	5 U	5 U	**57 J**	1 U	1 U	1 U
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	1 U	1 U	1 U	1 U	**2**	1 UR	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UR	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U
7440-36-0	Antimony	ug/L	6	MCLG	2 U	2 U	2 U	2 U	2 U	2 U	**33.2**	2 U	2 U	2 U
7440-38-2	Arsenic	ug/L	10	MCL	**1.2 J**	4 U	4 U	**4.3**	**2.8 J**	4 U	**417**	4 U	4 U	4 U
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	4 U	4 U	4 U	4 U	4 U	4 U	**77.4**	4 U	4 U	4 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.45 J**	**0.3 J**	**3.7**	**0.53 J**	**4.8**	1 U	**514**	**0.34 J**	**0.14 J**	1 U
7439-89-6	Iron	ug/L	26000	RBC	**26.5 J**	**29.2 J**	**4640**	**3420**	**13100**	**24.4 J**	**90.8 J**	**7320**	**8060 J**	**8250 J**
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	880	RBC	**75.9**	**8.5**	**6280**	**1140**	**4790**	**2.7**	**6.9**	**994**	**2030**	**2080**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 UJ-	**0.13 J**-	0.2 U	0.2 U	0.2 U
7440-02-0	Nickel	ug/L	730	RBC	**2.8 J**	**2.9 J**	**0.99 J**	**13.2**	**82.6**	**1.2 J**	**1820**	**1.1 J**	4 U	4 U
7440-62-2	Vanadium	ug/L	260	RBC	**1.8**	1 U	1 U	1 U	1 U	1 U	**71.8**	1 U	**0.3 J**	1 U
7440-66-6	Zinc	ug/L	11000	RBC	30 U	30 U	**53.5**	30 U	30 U	30 U	**211**	30 U	30 U	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	6 U	6 U	6 U	6 U	**4 J**	6 UJ	150 UJ	6 UJ	6 U	**2.4 J**
	FIELD PARAMETERS													
	Temperature	°C	---	---	22.17	18.75	21.4	24.94	21.77	28.86	18.56	18.84	22	22
	Conductivity	mS/cm	---	---	2.1	1.1	3	3.4	3.3	0.4	2.6	1.3	2.3	2.3
	pH	s.u.	---	---	7.27	6.19	6.8	7.38	6.49	8.5	9.28	6.74	6.66	6.66
	ORP	mV	---	---	44.38	290.09	10.03	-155.19	7.1	98.84	-477.5	-51.3	-42.23	-42.23
	Turbidity	NTU	---	---	243	4.52	30.1	18.1	8.96	26.5	301	19.8	2.06	2.06
	Dissolved Oxygen	mg/L	---	---	1.72	0.84	0.05	0.23	0.33	7.18	0	0.12	0.06	0.06

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.
[2] - Reported standard is for Mercury as Methyl.
Bold text indicates detected value.
MCL = Maximum Contaminant Level MCLG = MCL Goal
RBC = Risk Based Concentration AL = Action Level
U = Not Detected J = Estimated value (+ high bias - low bias)
R = Rejected mg/L = miligrams per liter mV = millivolts
ug/L = micrograms per liter mS/cm = milisiemens per centimeter
s.u = std. units NTU = nephelometric turbidity unit
= Detected value exceeds groundwater cleanup standard.

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TABLE 9

OU-7 Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		133 7968062 S BMW AVX05 7/15/2015 9:05 11/26/2015	136 7968053 I BMW AVX05 7/13/2015 12:45 11/26/2015	138 7984573 S BMW AVX15 7/28/2015 11:20 11/26/2015	162 7968054 S BMW AVX05 7/13/2015 17:30 11/26/2015	181 7968055 I BMW AVX05 7/13/2015 14:15 11/26/2015	185 7968056 S BMW AVX05 7/13/2015 15:50 11/26/2015	203 7981299 I BMW AVX11 7/26/2015 15:40 11/26/2015	205 7993584 I BMW AVX16 8/5/2015 9:10 11/26/2015	206 7968058 I BMW AVX05 7/14/2015 10:47 11/26/2015	210 7979540 I BMW AVX07 7/23/2015 15:10 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	5 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U	20 U	20 U
75-15-0	Carbon Disulfide	ug/L	1000	RBC	**8.6**	5 U	**410**	5 U	5 U	5 U	5 U	**1300**	**7500**	5 U
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**2**	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**2**	1 U	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**64**	1 U	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**29.3 J**	**49.3 J**	200 U
7440-36-0	Antimony	ug/L	6	MCLG	2 U	**0.65 J**	**3.2**	2 U	2 U	2 U	2 U	**225**	**23.1**	2 U
7440-38-2	Arsenic	ug/L	10	MCL	**30.7**	4 U	**56.3**	4 U	**0.98 J**	4 U	4 U	**509**	**121**	4 U
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	**1.1 J**	4 U	**0.75 J**	4 U	4 U	4 U	4 U	**42.9**	**2.8 J**	4 U
7440-48-4	Cobalt	ug/L	11	RBC	**14.8**	1 U	**22.2**	**0.73 J**	1 U	**0.12 J**	1 U	**96.9**	**32.4**	1 U
7439-89-6	Iron	ug/L	26000	RBC	**6400**	**692**	200 U	**569**	**239**	**1530**	**4560**	**1920**	200 U	200 U
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	880	RBC	**782**	**209**	**364**	**231**	**363**	**183**	**497**	**197**	**9.3**	**29.1**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 U	0.2 U
7440-02-0	Nickel	ug/L	730	RBC	**18.4**	**0.95 J**	**59.1**	**2.1 J**	4 U	**1.4 J**	4 U	**182**	**33.7**	**8**
7440-62-2	Vanadium	ug/L	260	RBC	**0.63 J**	1 U	**3.1**	1 U	**0.27 J**	1 U	1 U	**7.5**	**10.4**	1 U
7440-66-6	Zinc	ug/L	11000	RBC	30 U	30 U	30 U	30 U	30 U	30 U	30 U	**66.7**	30 U	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	6 UJ	6 UJ	1200 U	6 UJ	6 UJ	6 UJ	**2.5 J**	300 UJ	**53 J**	6 U
	FIELD PARAMETERS													
	Temperature	°C	---	---	20.29	16.94	17.45	21.42	19.27	16.69	22.55	19.68	24.28	17.61
	Conductivity	mS/cm	---	---	7	0.5	3.4	0.6	0.8	0.4	1.2	10.8	4.1	1.2
	pH	s.u.	---	---	7.25	7.84	7.15	7.3	7.83	6.84	7.44	9.5	7.49	9.32
	ORP	mV	---	---	-84.12	-167.7	-319.43	-64.2	-226.2	-62.1	-119.98	-443.4	-367.8	-97.56
	Turbidity	NTU	---	---	8.31	15.2	0.74	119.2	24.5	141.7	4.15	18.5	5.17	9.21
	Dissolved Oxygen	mg/L	---	---	0.11	0.21	0.15	1.06	0.28	0.52	0.16	0	0.14	0.18

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.

[2] - Reported standard is for Mercury as Methyl.

Bold text indicates detected value.

MCL = Maximum Contaminant Level MCLG = MCL Goal

RBC = Risk Based Concentration AL = Action Level

U = Not Detected J = Estimated value (+ high bias - low bias)

R = Rejected mg/L = miligrams per liter mV = millivolts

ug/L = micrograms per liter mS/cm = milisiemens per centimeter

s.u = std. units NTU = nephelometric turbidity unit

= Detected value exceeds groundwater cleanup standard.

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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		215 7976192 I BMW AVX06 7/22/2015 9:50 11/26/2015	216 7981300 I BMW AVX11 7/27/2015 11:05 11/26/2015	232 7981301 I BMW AVX11 7/25/2015 10:45 11/26/2015	238 7993585 I BMW AVX16 8/4/2015 9:55 11/26/2015	301 7979541 D BMW AVX07 7/22/2015 19:20 11/26/2015	305 7984574 D BMW AVX15 7/28/2015 17:40 11/26/2015	306 8129733 D BMW AVX26 11/10/2015 13:30 2/21/2016	316 7984575 D BMW AVX15 7/28/2015 9:15 11/26/2015	336 7976193 D BMW AVX06 7/21/2015 17:05 11/26/2015	338 7993586 D BMW AVX16 8/4/2015 15:50 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	**140**	20 U	20 U	**16 J**	20 U	**700**	20 U	20 U	**940**	20 U
75-15-0	Carbon Disulfide	ug/L	1000	RBC	**930**	**1000**	**5**	**290**	5 U	**28000**	**25**	**520**	**14000**	**33**
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	1 U	1 U	1 U	**6**	1 U	1 U	**4**	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	**5**	1 U	1 U	1 U	1 U	**4**	1 U	1 U	**6**	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	0.5 U	0.5 U	**0.6**	**12**	**0.8**	0.5 U	0.5 U	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	**48**	1 U	1 U	1 U	1 U	**240**	1 U	1 U	**1100**	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	200 U	**31.4 J**	200 U	200 U	200 U	200 U	200 U	200 U	**27.1 J**	200 U
7440-36-0	Antimony	ug/L	6	MCLG	2 U	**39.1**	2 U	**28.6**	2 U	**685**	**1.3 J**	**6.1**	**320**	**3.1**
7440-38-2	Arsenic	ug/L	10	MCL	**1.1 J**	**199**	**1.2 J**	**154**	4 U	**3010**	**22.7**	**70.5**	**980**	**41**
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	4 U	**7.2**	4 U	**0.96 J**	4 U	**12.6**	**1.2 J**	4 U	**8.6**	4 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.22 J**	**72.4**	**0.68 J**	**9.4**	1 U	**171**	**1.2**	**17.4**	**90**	**10**
7439-89-6	Iron	ug/L	26000	RBC	**25.7 J**	**87.8 J**	**255**	**50.4 J**	**561**	**380**	200 U	**23.3 J**	**43.7 J**	200 U
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	2 U	2 U	2 U	**0.27 J**	2 U	2 U	**18.3**	2 U
7439-96-5	Manganese	ug/L	880	RBC	**1 J**	**74.6**	**67.7**	**26.4**	**13.6**	**54.2**	**1.5 J**	**43.8**	**4.6**	**12**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 U	1 U	0.2 U	0.2 U	0.2 U	0.2 UJ-
7440-02-0	Nickel	ug/L	730	RBC	**1.3 J**	**188**	**1.5 J**	**18.7**	4 U	**102**	**4.5**	**54.1**	**46.8**	**27.2**
7440-62-2	Vanadium	ug/L	260	RBC	1 U	**2.8**	1 U	**6.2**	1 U	**3.2**	**1.7**	**0.86 J**	**6.4**	**4.3**
7440-66-6	Zinc	ug/L	11000	RBC	30 U	**44.1**	**8.3 J**	30 U	30 U	**59.5**	30 U	30 U	**24.7 J**	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	**29**	**28**	**2.3 J**	300 UJ	6 U	1200 U	**8.4**	600 U	**90 J**	300 UJ
	FIELD PARAMETERS													
	Temperature	°C	---	---	15.54	25.91	18.73	21.4	18.34	20.03	12.98	21.64	19.5	22.78
	Conductivity	mS/cm	---	---	1.8	7.3	4.2	3	0.5	17	1.7	4.5	9.3	1.3
	pH	s.u.	---	---	11.78	9.95	7.51	7.33	7.71	9.42	9.31	8.93	8.37	7.78
	ORP	mV	---	---	-158.4	-259.5	100.02	-385.05	-123.95	-484.4	-202.7	-416.14	-376.96	-363.06
	Turbidity	NTU	---	---	10.4	18.5	58.6	1.5	1.69	53.2	0.2	15.4	1.6	0.8
	Dissolved Oxygen	mg/L	---	---	0.21	0.02	0.19	0.07	0.13	0.1	0.93	0.03	0.06	0

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.

[2] - Reported standard is for Mercury as Methyl.

Bold text indicates detected value.

MCL = Maximum Contaminant Level MCLG = MCL Goal

RBC = Risk Based Concentration AL = Action Level

U = Not Detected J = Estimated value (+ high bias - low bias)

R = Rejected mg/L = miligrams per liter mV = millivolts

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s.u = std. units NTU = nephelometric turbidity unit

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FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		501A 7968059 D BMW AVX05 7/14/2015 16:14 11/26/2015	501B 7968060 D BMW AVX05 7/14/2015 14:14 11/26/2015	501C 7976194 D BMW AVX06 7/21/2015 13:55 11/26/2015	601 7998206 D BMW AVX18 8/6/2015 11:05 11/26/2015	602 7976195 D BMW AVX06 7/22/2015 11:55 11/26/2015	603-Z1 7964616 D BMW AVX02 7/10/2015 12:25 11/26/2015	603-Z2 7964617 D BMW AVX02 7/10/2015 12:37 11/26/2015	603-Z3 7964618 D BMW AVX02 7/10/2015 12:48 11/26/2015	603-Z4 7964619 D BMW AVX02 7/10/2015 13:02 11/26/2015	604-Z1 7963079 D BMW AVX01 7/9/2015 11:35 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
75-15-0	Carbon Disulfide	ug/L	1000	RBC	5 U	5 U	5 U	**1 J**	5 U	**98**	**61**	**140**	**12**	5 U
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	200 U	**32.6 J**	200 U	**342**	**109 J**	200 U	200 U	200 U	200 U	200 U
7440-36-0	Antimony	ug/L	6	MCLG	2 U	2 U	2 U	2 U	2 U	**4.1**	**4.1**	**4.8**	2 U	2 U
7440-38-2	Arsenic	ug/L	10	MCL	**1.7 J**	**1.9 J**	**4.2**	**2.9 J**	**3.9 J**	**27.4**	**35.9**	**35.8**	**11**	4 U
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-48-4	Cobalt	ug/L	11	RBC	**0.15 J**	1 U	1 U	1 U	1 U	**6.9**	**7.1**	**9.2**	**1**	1 U
7439-89-6	Iron	ug/L	26000	RBC	200 U	200 U	200 U	**26.8 J**	200 U	200 U	200 U	200 U	200 U	**362**
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	2 U	**0.17 J**	2 U	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	880	RBC	**3.1**	**3.4**	**3.8**	**0.96 J**	**2**	**29.4**	**51**	**25**	**22.3**	**236**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 U	0.2 UJ-	0.2 UJ-	0.2 UJ-	0.2 UJ-	0.2 U
7440-02-0	Nickel	ug/L	730	RBC	**2.1 J**	4 U	**1.1 J**	**1.3 J**	4 U	**10.5**	**11.2**	**18.9**	**3.6 J**	4 U
7440-62-2	Vanadium	ug/L	260	RBC	1 U	1 U	**0.34 J**	**0.69 J**	**0.54 J**	**0.97 J**	**1.1**	**1.2**	1 U	1 U
7440-66-6	Zinc	ug/L	11000	RBC	30 U	30 U	30 U	30 U	**15.4 J**	30 U	30 U	30 U	30 U	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	6 UJ	6 UJ	6 U	**4.3 J**	6 U	150 UJ	150 UJ	150 UJ	150 UJ	6 U
	FIELD PARAMETERS													
	Temperature	°C	---	---	19.94	20.35	21.64	20.58	16.96	14.89	15.12	14.81	15.07	18.93
	Conductivity	mS/cm	---	---	0.8	0.5	0.8	0.6	0.6	1.6	1.7	1.7	0.8	0.7
	pH	s.u.	---	---	9.13	9.08	8.95	9.88	9.5	7.46	7.36	7.47	7.65	7.5
	ORP	mV	---	---	-321.75	-283.14	-108.16	541.06	192.86	-373.6	-376.4	-372.1	-386.6	-39
	Turbidity	NTU	---	---	4.15	5.95	10.1	9.1	2.03	0.63	0.47	0.47	0.37	0.81
	Dissolved Oxygen	mg/L	---	---	0.17	0.22	0.12	0.16	0.42	0	0	0	0	0.03

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.

[2] - Reported standard is for Mercury as Methyl.

Bold text indicates detected value.

MCL = Maximum Contaminant Level MCLG = MCL Goal

RBC = Risk Based Concentration AL = Action Level

U = Not Detected J = Estimated value (+ high bias - low bias)

R = Rejected mg/L = miligrams per liter mV = millivolts

ug/L = micrograms per liter mS/cm = milisiemens per centimeter

s.u = std. units NTU = nephelometric turbidity unit

= Detected value exceeds groundwater cleanup standard.

TABLE 9

OU-7 Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		604-Z2 7963080 D BMW AVX01 7/9/2015 11:55 11/26/2015	604-Z3 7963081 D BMW AVX01 7/9/2015 12:04 11/26/2015	604-Z4 7963082 D BMW AVX01 7/9/2015 12:15 11/26/2015	605A 7964620 D BMW AVX02 7/11/2015 12:45 11/26/2015	605B 7968063 D BMW AVX05 7/15/2015 9:15 11/26/2015	606A 7963083 D BMW AVX01 7/9/2015 10:54 11/26/2015	606B 7968061 D BMW AVX05 7/14/2015 11:55 11/26/2015	GM-02A 7963084 S BMW AVX01 7/9/2015 15:25 11/26/2015	GM-02B 7963085 I BMW AVX01 7/9/2015 16:24 11/26/2015	GM-09R 7981302 I BMW AVX11 7/24/2015 15:00 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	20 U	20 U	**15 J**	20 U	**9 J**	20 U	20 U	20 U	200 U	20 U
75-15-0	Carbon Disulfide	ug/L	1000	RBC	5 U	5 U	5 U	**13**	**2 J**	5 U	**1 J**	**86**	**47 J**	**3 J**
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.9 J**	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.7 J**	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	0.5 U	0.5 U	**3**	0.5 U	0.5 U	**0.5 J**	**0.4 J**	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	200 U	200 U	200 U	**56.7 J**	**60.6 J**	200 U	**28.5 J**	200 U	**80.8 J**	200 U
7440-36-0	Antimony	ug/L	6	MCLG	2 U	2 U	2 U	**3.8**	2 U	2 U	2 U	2 U	**137**	2 U
7440-38-2	Arsenic	ug/L	10	MCL	4 U	**0.58 J**	**1.6 J**	**10.7**	**8.1**	**0.79 J**	**1.7 J**	**19.6**	**296**	**0.76 J**
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	**3.6 J**	4 U
7440-48-4	Cobalt	ug/L	11	RBC	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**2.2**	**89**	**0.62 J**
7439-89-6	Iron	ug/L	26000	RBC	**313**	**282**	**29.8 J**	200 U	200 U	200 U	200 U	**25.7 J**	**218**	**242**
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	2 U	**0.17 J**	2 U	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	880	RBC	**227**	**230**	**31.8**	2 U	**6.3**	**4.3**	**6.9**	**4.3**	**15.1**	**2300**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-02-0	Nickel	ug/L	730	RBC	4 U	4 U	4 U	**1.2 J**	**2.8 J**	**1.1 J**	4 U	**6.9**	**204**	**16.4**
7440-62-2	Vanadium	ug/L	260	RBC	1 U	1 U	1 U	**1.5**	**2.9**	1 U	**0.37 J**	**1.2**	**2.9**	**1.6**
7440-66-6	Zinc	ug/L	11000	RBC	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	6 U	6 U	6 U	6 UJ	6 UJ	6 U	6 UJ	150 U	300 U	**4.1 J**
	FIELD PARAMETERS													
	Temperature	°C	---	---	19.41	17.03	18.65	17.55	15.04	23.59	18.75	21.07	22.83	26.92
	Conductivity	mS/cm	---	---	0.7	0.7	0.8	0.6	1.6	0.7	1	0.9	9.8	4.3
	pH	s.u.	---	---	7.85	7.86	8.28	9.71	9.29	9.01	8.86	9.01	8.44	6.8
	ORP	mV	---	---	-114.4	-73.1	-53.4	-115.66	-107.74	-392.1	-57.41	-422.8	-514.8	-301.22
	Turbidity	NTU	---	---	0.92	1.28	1.06	1.55	20.2	-0.7	1.05	13.6	1.6	28.1
	Dissolved Oxygen	mg/L	---	---	0	0	0.06	0	0	0.11	0.07	0.08	0.16	0.05

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.

[2] - Reported standard is for Mercury as Methyl.

Bold text indicates detected value.

MCL = Maximum Contaminant Level MCLG = MCL Goal

RBC = Risk Based Concentration AL = Action Level

U = Not Detected J = Estimated value (+ high bias - low bias)

R = Rejected mg/L = miligrams per liter mV = millivolts

ug/L = micrograms per liter mS/cm = milisiemens per centimeter

s.u = std. units NTU = nephelometric turbidity unit

= Detected value exceeds groundwater cleanup standard.

TABLE 9

OU-7 Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Groundwater Data		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Groundwater Cleanup Standards[1]		MW-03R 7964623 S BMW AVX02 7/12/2015 15:05 11/26/2015	MW-03R (DUP) 7964627 S BMW AVX02 7/12/2015 15:05 11/26/2015	MW-09 7993587 OMW AVX16 8/4/2015 11:00 11/26/2015	MW-10 7984576 OMW AVX15 7/29/2015 9:10 11/26/2015	PW-0 7981318 I BMW AVX12 7/24/2015 16:50 11/26/2015	PW-0 (DUP) 7981322 I BMW AVX12 7/24/2015 16:50 11/26/2015	PW-02 7993588 I BMW AVX16 8/5/2015 11:20 11/26/2015	PZ-06 7993589 S BMW AVX16 8/4/2015 15:10 11/26/2015	WP-10 7984577 OMW AVX15 7/29/2015 10:40 11/26/2015	WP-11 7993591 OMW AVX16 8/4/2015 9:15 11/26/2015
CAS NO.	COMPOUND	UNITS:												
	VOLATILES													
67-64-1	Acetone	ug/L	22000	RBC	200 U	200 U	**2800**	20 U	20 U	20 U	20 U	20 U	20 U	**67**
75-15-0	Carbon Disulfide	ug/L	1000	RBC	**2600**	**2600**	**750**	**18**	5 U	5 U	**180**	5 U	**36**	5 U
	SEMIVOLATILES													
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	6	MCL	5 U	5 U	50 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	1800	RBC	1 U	1 U	**260**	1 U	1 U	1 U	1 U	1 U	**1**	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	180	RBC	1 U	1 U	**190**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene	ug/L	14	RBC	0.5 U	0.5 U	5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.6 U	**14**	0.5 U
87-86-5	Pentachlorophenol	ug/L	1	MCL	5 U	5 U	50 U	5 U	5 UJ	5 UJ	5 U	6 U	5 U	5 U
108-95-2	Phenol	ug/L	11000	RBC	1 U	1 U	**25000**	1 U	1 U	1 U	**1**	1 U	1 U	1 U
	METALS - DISSOLVED													
7429-90-5	Aluminum	ug/L	37000	RBC	**35.1 J**	**35.1 J**	**175 J+**	**310**	200 U	200 U	**30 J+**	**27.5 J+**	**53 J**	200 U
7440-36-0	Antimony	ug/L	6	MCLG	**14.4**	**10.4**	**74.3**	2 U	2 U	**0.53 J**	**2.5**	2 U	**0.49 J**	2 U
7440-38-2	Arsenic	ug/L	10	MCL	**207**	**165**	**2480**	**18**	**0.74 J**	4 U	**35.8**	**8.2**	**182**	**2.3 J**
7440-43-9	Cadmium	ug/L	5	MCLG	1 U	1 U	**0.36 J**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	100	MCLG	**12**	**9.7**	**144**	**6.3**	4 U	4 U	**1.3 J**	4 U	**11.8**	4 U
7440-48-4	Cobalt	ug/L	11	RBC	**139**	**114**	**758**	**71.5**	1 U	**0.15 J**	**5.1**	**0.45 J**	**174**	**2.4**
7439-89-6	Iron	ug/L	26000	RBC	**39.2 J**	**28.8 J**	**591**	**367000**	**559**	**530**	**97.7 J**	**140 J**	**201**	**13100**
7439-92-1	Lead	ug/L	15	AL	2 U	2 U	**0.27 J**	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	880	RBC	**526**	**492**	**97.8**	**22100**	**1530**	**1440**	**12.3**	**106**	**32**	**1580**
7439-97-6	Mercury[2]	ug/L	2	MCLG	0.2 UJ-	0.2 UJ-	1 UJ-	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 UJ-	1 U	0.2 UJ-
7440-02-0	Nickel	ug/L	730	RBC	**491**	**417**	**2140**	**30.1**	**23.8**	**22.8**	**11.6**	**7.4**	**546**	**2.1 J**
7440-62-2	Vanadium	ug/L	260	RBC	**18.3**	**15.9**	**619**	**8.1**	**0.68 J**	**0.76 J**	**2.8**	**0.33 J**	**37.1**	**0.45 J**
7440-66-6	Zinc	ug/L	11000	RBC	30 U	30 U	**6960**	**12.1 J**	30 U	30 U	30 U	30 U	**13.3 J**	30 U
	OTHER													
FREE CN	Cyanide (Free)	ug/L	200	MCLG	**53 J**	150 UJ	300 UJ	**3.7 J**	6 U	6 U	300 UJ	6 UJ	**18**	6 UJ
	FIELD PARAMETERS													
	Temperature	°C	---	---	20.65	20.65	25.16	23	6.53	6.53	19.5	20.95	25.06	20.83
	Conductivity	mS/cm	---	---	9.8	9.8	34.7	9.6	2.4	2.4	1.9	2.4	13.4	2.4
	pH	s.u.	---	---	7.54	7.54	9.44	6.16	-217.4	-217.4	8.78	7.51	9.32	6.79
	ORP	mV	---	---	-382.83	-382.83	-391.8	-31.54	0.29	0.29	-326.55	15.57	105.42	-39.13
	Turbidity	NTU	---	---	59.7	59.7	3.62	10.9	21.14	21.14	2.63	6.48	3.52	10.6
	Dissolved Oxygen	mg/L	---	---	0	0	0	0.11	4.72	4.72	-0.01	0.39	0.01	0.16

[1] - Groundwater cleanup standards as presented in Table 7 of the ROD.

[2] - Reported standard is for Mercury as Methyl.

Bold text indicates detected value.

MCL = Maximum Contaminant Level MCLG = MCL Goal

RBC = Risk Based Concentration AL = Action Level

U = Not Detected J = Estimated value (+ high bias - low bias)

R = Rejected mg/L = miligrams per liter mV = millivolts

ug/L = micrograms per liter mS/cm = milisiemens per centimeter

s.u = std. units NTU = nephelometric turbidity unit

= Detected value exceeds groundwater cleanup standard.

Table H-6: OU7 Surface Water Analytical Results – 2015

Source: 2015 Annual Report

TABLE 21

OU-7 River Water Sample Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Surface Water Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening	SW-01 7964880/7964881 AVX04 WATER 7/11/2015 9:40 11/28/2015	SW-02 7964882/7964883 AVX04 WATER 7/11/2015 9:50 11/28/2015	SW-03 7964884/7964885 AVX04 WATER 7/11/2015 11:20 11/28/2015	SW-04 7964886/7964890 AVX04 WATER 7/11/2015 11:50 11/28/2015	SW-04 (DUP) 7964894/7964895 AVX04 WATER 7/11/2015 11:50 11/28/2015	SW-05 7964900/7964901 AVX04 WATER 7/12/2015 10:00 11/28/2015	SW-06 7964902/7964903 AVX04 WATER 7/12/2015 10:40 11/28/2015	SW-07 7964904/7964905 AVX04 WATER 7/12/2015 10:50 11/28/2015	SW-08 7964906/7964907 AVX04 WATER 7/12/2015 12:10 11/28/2015
CAS NO.	COMPOUND	UNITS:	Criteria[1]									
	VOLATILES											
67-64-1	Acetone	ug/L	NV	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
75-15-0	Carbon Disulfide	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
108-90-7	Chlorobenzene	ug/L	130	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	SEMIVOLATILES											
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	NV	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene[2]	ug/L	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-86-5	Pentachlorophenol	ug/L	6.7	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
108-95-2	Phenol	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	METALS - TOTAL											
7429-90-5	Aluminum	ug/L	NV	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U
7440-36-0	Antimony	ug/L	5.6	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7440-38-2	Arsenic	ug/L	NV	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-43-9	Cadmium	ug/L	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	11	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
7440-48-4	Cobalt	ug/L	NV	**0.14 J**	**0.17 J**	**0.15 J**	**0.21 J**	**0.15 J**	**0.17 J**	**0.18 J**	**0.2 J**	**0.2 J**
7439-89-6	Iron	ug/L	NV	**60 J**	**73.4 J**	**55.2 J**	**51.8 J**	**47.9 J**	**45.7 J**	**45.6 J**	**45.8 J**	**50.3 J**
7439-92-1	Lead	ug/L	14	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	NV	**7.6 J**	**8.2 J**	**6.8 J**	**6.6 J**	**6.3 J**	**6 J**	**5.6 J**	**6.1 J**	**6.3 J**
7439-97-6	Mercury	ug/L	0.77	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-02-0	Nickel	ug/L	20	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
7440-62-2	Vanadium	ug/L	NV	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
7440-66-6	Zinc	ug/L	120	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U
	METALS - DISSOLVED											
7429-90-5	Aluminum	ug/L	NV	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U
7440-36-0	Antimony	ug/L	5.6	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7440-38-2	Arsenic	ug/L	NV	**0.58 J**	4 U	4 U	**0.56 J**	**0.57 J**	4 U	4 U	4 U	4 U
7440-43-9	Cadmium	ug/L	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	11	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
7440-48-4	Cobalt	ug/L	NV	**0.2 J**	**0.28 J**	**0.37 J**	**0.29 J**	**0.19 J**	**0.2 J**	**0.27 J**	**0.16 J**	**0.24 J**
7439-89-6	Iron	ug/L	NV	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U
7439-92-1	Lead	ug/L	14	2 U	2 U	2 U	**0.25 J**	2 U	2 U	2 U	2 U	2 U
7439-96-5	Manganese	ug/L	NV	**3.4 J**	**3.5 J**	**3.2 J**	**3.1 J**	**3.1 J**	**3.2 J**	**2.5 J**	**2.8 J**	**3.2 J**
7439-97-6	Mercury	ug/L	0.77	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

[1]Screening criteria, where available, are based on the Virginia Chronic Water Quality Criteria (9 VAC 25-260-140) (updated January 2011).
[2]Screening criteria for naphthalene is based on Region III BTAG Aquatic Freshwater Screening Levels (July 2006).
NV - No Value Available
Detected value exceeds Screening Criteria.

PARSONS

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TABLE 21

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FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Surface Water Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening	SW-01 7964880/7964881 AVX04 WATER 7/11/2015 9:40 11/28/2015	SW-02 7964882/7964883 AVX04 WATER 7/11/2015 9:50 11/28/2015	SW-03 7964884/7964885 AVX04 WATER 7/11/2015 11:20 11/28/2015	SW-04 7964886/7964890 AVX04 WATER 7/11/2015 11:50 11/28/2015	SW-04 (DUP) 7964894/7964895 AVX04 WATER 7/11/2015 11:50 11/28/2015	SW-05 7964900/7964901 AVX04 WATER 7/12/2015 10:00 11/28/2015	SW-06 7964902/7964903 AVX04 WATER 7/12/2015 10:40 11/28/2015	SW-07 7964904/7964905 AVX04 WATER 7/12/2015 10:50 11/28/2015	SW-08 7964906/7964907 AVX04 WATER 7/12/2015 12:10 11/28/2015
CAS NO.	COMPOUND	UNITS:	Criteria[1]									
7440-02-0	Nickel	ug/L	20	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
7440-62-2	Vanadium	ug/L	NV	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
7440-66-6	Zinc	ug/L	120	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	**4.9 J**
	OTHER											
57-12-5	Cyanide, Total	ug/L	5.2	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
FREE CN	Cyanide (Free)	ug/L	5.2	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
	FIELD PARAMETERS											
	Temperature	°C	---	25.6	25.64	26.87	26.89	26.89	24.53	25.36	25.91	27.61
	Conductivity	mS/cm	---	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	pH	s.u.	---	7.94	8.31	8.59	8.65	8.65	8.23	8.51	8.64	8.66
	ORP	mV	---	181.84	154.68	102.12	88.3	88.3	95.38	84.93	81.4	95.51
	Turbidity	NTU	---	11.5	33	2.87	2.5	2.5	4.58	2.31	2.32	1.95
	Dissolved Oxygen	mg/L	---	7.43	7.51	8.93	8.98	8.98	7.94	8.53	8.78	9.2

[1]Screening criteria, where available, are based on the Virginia Chronic Water Quality Criteria (9 VAC 25-260-140) (updated January 2011).
[2]Screening criteria for naphthalene is based on Region III BTAG Aquatic Freshwater Screening Levels (July 2006).
NV - No Value Available
 – Detected value exceeds Screening Criteria.

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Table H-7: OU7 Sediment Analytical Results – 2015

Source: 2015 Annual Report

TABLE 20

OU-7 River Sediment Sample Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Sediment Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening	SED-01 7964870 AVX04 SOIL 7/11/2015 9:30 11/28/2015	SED-02 7964871 AVX04 SOIL 7/11/2015 10:00 11/28/2015	SED-03 7964872 AVX04 SOIL 7/11/2015 11:15 11/28/2015	SED-04 7964873 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-04 (DUP) 7964877 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-05 7964896 AVX04 SOIL 7/12/2015 10:05 11/28/2015	SED-06 7964897 AVX04 SOIL 7/12/2015 10:45 11/28/2015	SED-07 7964898 AVX04 SOIL 7/12/2015 10:55 11/28/2015	SED-08 7964899 AVX04 SOIL 7/12/2015 12:15 11/28/2015
CAS NO.	COMPOUND	UNITS:	Criteria[1]									
	VOLATILES											
67-64-1	Acetone	ug/kg	NV	47	100 J	22	66	60	24	31	21	94
75-15-0	Carbon Disulfide	ug/kg	0.851	9	23 J	24	100	62	16	4 J	11	3 J
108-90-7	Chlorobenzene	ug/kg	8.42	7 U	5 UR	4 U	6 U	5 U	4 U	6 U	2 U	8 U
	SEMIVOLATILES											
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/kg	180	200 U	220 U	200 U	220 U	210 U	200 U	250 U	200 U	350 U
95-48-7	2-Methylphenol (O-Cresol)	ug/kg	NV	39 U	43 U	39 U	44 U	42 U	40 U	50 U	40 U	68 U
106-44-5	4-Methylphenol (P-Cresol)	ug/kg	670	39 U	43 U	39 U	30 J	42 U	40 U	50 U	40 U	1600
91-20-3	Naphthalene	ug/kg	176	20 U	22 U	20 U	22 U	21 U	11 J	10 J	5 J	17 J
87-86-5	Pentachlorophenol	ug/kg	504	200 U	220 U	200 U	220 U	210 U	200 U	250 U	200 U	350 U
108-95-2	Phenol	ug/kg	420	39 U	43 U	39 U	44 U	42 U	40 U	50 U	40 U	370
	METALS											
7429-90-5	Aluminum	mg/kg	NV	6370	4810	3260	9560	9250	4870	14000	6810	14200
7440-36-0	Antimony	mg/kg	2	0.0998 J-	0.516 UJ-	0.452 UJ-	0.295 J-	0.22 J-	0.47 UJ-	0.192 J-	0.101 J-	0.228 J-
7440-38-2	Arsenic	mg/kg	9.8	2.87 J-	2.76 J-	2.25 J-	6.11 J-	4.51 J-	2.4 J-	5.13 J-	3.04 J-	5.48 J-
7440-43-9	Cadmium	mg/kg	0.99	0.0844 J	0.0438 J	0.031 J	0.142 J	0.0984 J	0.0378 J	0.0765 J	0.0899 J	0.147 J
7440-47-3	Chromium	mg/kg	43.4	14.1	13.4	14.8	17.7	19	13	16.4	10.9	28.5
7440-48-4	Cobalt	mg/kg	50	5.13 J	4.41 J	3.96 J	6.76 J	6.87 J	4.82 J	10.6 J	5.37 J	12.9 J
7439-89-6	Iron	mg/kg	20000	14300	13500	13000	16800	17900	15900	18600	12800	40300
7439-92-1	Lead	mg/kg	35.8	9.73 J	6.47 J	4.24 J	14.2 J	13.2 J	6.49 J	15.8 J	9.71 J	20.1 J
7439-96-5	Manganese	mg/kg	460	250	241	163	501	387	224	791	278	1000
7439-97-6	Mercury	mg/kg	0.18	0.0913 J-	0.123 J-	0.0424 J-	0.672 J-	0.347 J-	0.103 J-	0.0784 J-	0.21 J-	0.302 J-
7440-02-0	Nickel	mg/kg	22.7	6.62	5.89	4.2	9.63	9.64	5.27	12.4	6.54	14.4
7440-62-2	Vanadium	mg/kg	NV	18.9	16.3	15.6	22.9	22.2	18	33.8	17.2	64.3
7440-66-6	Zinc	mg/kg	121	43.3	26.8	22.1	117	112	33	37.4	32.1	72.8
	OTHER											
57-12-5	Cyanide, Total	mg/kg	NV	0.59 U	0.62 U	0.58 U	0.66 U	0.6 U	0.6 U	0.73 U	0.57 U	0.97 U
FREE CN	Cyanide (Free)	mg/kg	0.1	0.7 U	0.78 U	0.7 U	0.78 U	0.75 U	0.72 U	0.89 U	0.72 U	1.2 U
MOIST	Moisture, Percent	%	-	15.3	23.3	15	24.6	21	17.3	33.3	17	51.4
TOC	Total Organic Carbon	mg/kg	NV	7400	650	146 J	10500	10300	3620	18400	5470	48900
SOLID	Total Solids	%	-	84.7	76.7	85	75.4		82.7	66.7	83	48.6

NV - No value available.
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
= Detected value exceeds screening criteria.

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TABLE 20

OU-7 River Sediment Sample Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Sediment Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening Criteria[1]	SED-01 7964870 AVX04 SOIL 7/11/2015 9:30 11/28/2015	SED-02 7964871 AVX04 SOIL 7/11/2015 10:00 11/28/2015	SED-03 7964872 AVX04 SOIL 7/11/2015 11:15 11/28/2015	SED-04 7964873 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-04 (DUP) 7964877 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-05 7964896 AVX04 SOIL 7/12/2015 10:05 11/28/2015	SED-06 7964897 AVX04 SOIL 7/12/2015 10:45 11/28/2015	SED-07 7964898 AVX04 SOIL 7/12/2015 10:55 11/28/2015	SED-08 7964899 AVX04 SOIL 7/12/2015 12:15 11/28/2015
CAS NO.	COMPOUND	UNITS:										
	GRAIN SIZE											
HYDROM0.001MM	Hydrometer 0.001 mm	% passed	-	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	**0.5**	0.5 U	0.5 U
HYDROM0.002MM	Hydrometer 0.002 mm	% passed	-	0.5 U	0.5 U	0.5 U	**0.5**		0.5 U	**5.5**	0.5 U	**1**
HYDROM0.005MM	Hydrometer 0.005 mm	% passed	-	0.5 U	0.5 U	0.5 U	**4**		0.5 U	**11.5**	**1**	**3**
HYDROM0.02MM	Hydrometer 0.02 mm	% passed	-	0.5 U	0.5 U	0.5 U	**14**		0.5 U	**26**	**6**	**13**
HYDROM0.05MM	Hydrometer 0.05 mm	% passed	-	**1.5**	**0.5**	**0.5**	**21.5**		**1.5**	**39**	**10.5**	**24**
HYDROM0.064MM	Hydrometer 0.064 mm	% passed	-	**3.5**	**2**	**1.5**	**27**		**4**	**44.5**	**14**	**32**
SIEVE200	Sieve 0.075 mm, Percent Passing	% passed	-	**5.4**	**3**	**2.2**	**30.7**		**5.6**	**47.7**	**15.8**	**35.6**
SIEVE100	Sieve 0.15 mm, Percent Passing	% passed	-	**10.2**	**8.5**	**3.2**	**41.9**		**8.2**	**58.8**	**23.3**	**42.7**
SIEVE50	Sieve 0.3 mm, Percent Passing	% passed	-	**29.7**	**33.5**	**6.2**	**63.7**		**21.2**	**67.2**	**38.6**	**49.7**
SIEVE30	Sieve 0.6 mm, Percent Passing	% passed	-	**55.5**	**80.5**	**21**	**88.9**		**46.1**	**73.8**	**59.2**	**56.4**
SIEVE16	Sieve 1.18 mm, Percent Passing	% passed	-	**67.2**	**92.7**	**63.7**	**91**		**65.6**	**74.9**	**65.7**	**62.9**
SIEVE19KU	Sieve 19 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**93.4**	**100**
SIEVE8	Sieve 2.36 mm, Percent Passing	% passed	-	**76.8**	**94.7**	**82.4**	**91.3**		**86**	**76.6**	**69.4**	**69.3**
SIEVE3.35KU	Sieve 3.35 mm, Percent Passing	% passed	-	**79.7**	**95.3**	**84.2**	**95.7**		**88**	**83.3**	**73**	**78**
SIEVE37.5KU	Sieve 37.5 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**
SIEVE4	Sieve 4.75 mm, Percent Passing	% passed	-	**83.2**	**96**	**86.4**	**98.3**		**89.5**	**91.9**	**76.7**	**85.4**
SIEVE75KU	Sieve 75 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**

NV - No value available.
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
= Detected value exceeds screening criteria.

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TABLE 20

OU-7 River Sediment Sample Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Sediment Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening Criteria[1]	SED-01 7964870 AVX04 SOIL 7/11/2015 9:30 11/28/2015	SED-02 7964871 AVX04 SOIL 7/11/2015 10:00 11/28/2015	SED-03 7964872 AVX04 SOIL 7/11/2015 11:15 11/28/2015	SED-04 7964873 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-04 (DUP) 7964877 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-05 7964896 AVX04 SOIL 7/12/2015 10:05 11/28/2015	SED-06 7964897 AVX04 SOIL 7/12/2015 10:45 11/28/2015	SED-07 7964898 AVX04 SOIL 7/12/2015 10:55 11/28/2015	SED-08 7964899 AVX04 SOIL 7/12/2015 12:15 11/28/2015
CAS NO.	COMPOUND	UNITS:										
	VOLATILES											
67-64-1	Acetone	ug/kg	NV	47	100 J	22	66	60	24	31	21	94
75-15-0	Carbon Disulfide	ug/kg	0.851	9	23 J	24	100	62	16	4 J	11	3 J
108-90-7	Chlorobenzene	ug/kg	8.42	7 U	5 UR	4 U	6 U	5 U	4 U	6 U	2 U	8 U
	SEMIVOLATILES											
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/kg	180	200 U	220 U	200 U	220 U	210 U	200 U	250 U	200 U	350 U
95-48-7	2-Methylphenol (O-Cresol)	ug/kg	NV	39 U	43 U	39 U	44 U	42 U	40 U	50 U	40 U	68 U
106-44-5	4-Methylphenol (P-Cresol)	ug/kg	670	39 U	43 U	39 U	30 J	42 U	40 U	50 U	40 U	1600
91-20-3	Naphthalene	ug/kg	176	20 U	22 U	20 U	22 U	21 U	11 J	10 J	5 J	17 J
87-86-5	Pentachlorophenol	ug/kg	504	200 U	220 U	200 U	220 U	210 U	200 U	250 U	200 U	350 U
108-95-2	Phenol	ug/kg	420	39 U	43 U	39 U	44 U	42 U	40 U	50 U	40 U	370
	METALS											
7429-90-5	Aluminum	mg/kg	NV	6370	4810	3260	9560	9250	4870	14000	6810	14200
7440-36-0	Antimony	mg/kg	2	0.0998 J-	0.516 UJ-	0.452 UJ-	0.295 J-	0.22 J-	0.47 UJ-	0.192 J-	0.101 J-	0.228 J-
7440-38-2	Arsenic	mg/kg	9.8	2.87 J-	2.76 J-	2.25 J-	6.11 J-	4.51 J-	2.4 J-	5.13 J-	3.04 J-	5.48 J-
7440-43-9	Cadmium	mg/kg	0.99	0.0844 J	0.0438 J	0.031 J	0.142 J	0.0984 J	0.0378 J	0.0765 J	0.0899 J	0.147 J
7440-47-3	Chromium	mg/kg	43.4	14.1	13.4	14.8	17.7	19	13	16.4	10.9	28.5
7440-48-4	Cobalt	mg/kg	50	5.13 J	4.41 J	3.96 J	6.76 J	6.87 J	4.82 J	10.6 J	5.37 J	12.9 J
7439-89-6	Iron	mg/kg	20000	14300	13500	13000	16800	17900	15900	18600	12800	40300
7439-92-1	Lead	mg/kg	35.8	9.73 J	6.47 J	4.24 J	14.2 J	13.2 J	6.49 J	15.8 J	9.71 J	20.1 J
7439-96-5	Manganese	mg/kg	460	250	241	163	501	387	224	791	278	1000
7439-97-6	Mercury	mg/kg	0.18	0.0913 J-	0.123 J-	0.0424 J-	0.672 J-	0.347 J-	0.103 J-	0.0784 J-	0.21 J-	0.302 J-
7440-02-0	Nickel	mg/kg	22.7	6.62	5.89	4.2	9.63	9.64	5.27	12.4	6.54	14.4
7440-62-2	Vanadium	mg/kg	NV	18.9	16.3	15.6	22.9	22.2	18	33.8	17.2	64.3
7440-66-6	Zinc	mg/kg	121	43.3	26.8	22.1	117	112	33	37.4	32.1	72.8
	OTHER											
57-12-5	Cyanide, Total	mg/kg	NV	0.59 U	0.62 U	0.58 U	0.66 U	0.6 U	0.6 U	0.73 U	0.57 U	0.97 U
FREE CN	Cyanide (Free)	mg/kg	0.1	0.7 U	0.78 U	0.7 U	0.78 U	0.75 U	0.72 U	0.89 U	0.72 U	1.2 U
MOIST	Moisture, Percent	%	-	15.3	23.3	15	24.6	21	17.3	33.3	17	51.4
TOC	Total Organic Carbon	mg/kg	NV	7400	650	146 J	10500	10300	3620	18400	5470	48900
SOLID	Total Solids	%	-	84.7	76.7	85	75.4		82.7	66.7	83	48.6

NV - No value available.
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
= Detected value exceeds screening criteria.

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TABLE 20

OU-7 River Sediment Sample Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated OU-7 Sediment Data		Location ID: Lab Sample Id: SDG: Matrix: Sampled: Validated:	Screening Criteria[1]	SED-01 7964870 AVX04 SOIL 7/11/2015 9:30 11/28/2015	SED-02 7964871 AVX04 SOIL 7/11/2015 10:00 11/28/2015	SED-03 7964872 AVX04 SOIL 7/11/2015 11:15 11/28/2015	SED-04 7964873 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-04 (DUP) 7964877 AVX04 SOIL 7/11/2015 12:00 11/28/2015	SED-05 7964896 AVX04 SOIL 7/12/2015 10:05 11/28/2015	SED-06 7964897 AVX04 SOIL 7/12/2015 10:45 11/28/2015	SED-07 7964898 AVX04 SOIL 7/12/2015 10:55 11/28/2015	SED-08 7964899 AVX04 SOIL 7/12/2015 12:15 11/28/2015
CAS NO.	COMPOUND	UNITS:										
	GRAIN SIZE											
HYDROM0.001MM	Hydrometer 0.001 mm	% passed	-	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	**0.5**	0.5 U	0.5 U
HYDROM0.002MM	Hydrometer 0.002 mm	% passed	-	0.5 U	0.5 U	0.5 U	**0.5**		0.5 U	**5.5**	0.5 U	**1**
HYDROM0.005MM	Hydrometer 0.005 mm	% passed	-	0.5 U	0.5 U	0.5 U	**4**		0.5 U	**11.5**	**1**	**3**
HYDROM0.02MM	Hydrometer 0.02 mm	% passed	-	0.5 U	0.5 U	0.5 U	**14**		0.5 U	**26**	**6**	**13**
HYDROM0.05MM	Hydrometer 0.05 mm	% passed	-	**1.5**	**0.5**	**0.5**	**21.5**		**1.5**	**39**	**10.5**	**24**
HYDROM0.064MM	Hydrometer 0.064 mm	% passed	-	**3.5**	**2**	**1.5**	**27**		**4**	**44.5**	**14**	**32**
SIEVE200	Sieve 0.075 mm, Percent Passing	% passed	-	**5.4**	**3**	**2.2**	**30.7**		**5.6**	**47.7**	**15.8**	**35.6**
SIEVE100	Sieve 0.15 mm, Percent Passing	% passed	-	**10.2**	**8.5**	**3.2**	**41.9**		**8.2**	**58.8**	**23.3**	**42.7**
SIEVE50	Sieve 0.3 mm, Percent Passing	% passed	-	**29.7**	**33.5**	**6.2**	**63.7**		**21.2**	**67.2**	**38.6**	**49.7**
SIEVE30	Sieve 0.6 mm, Percent Passing	% passed	-	**55.5**	**80.5**	**21**	**88.9**		**46.1**	**73.8**	**59.2**	**56.4**
SIEVE16	Sieve 1.18 mm, Percent Passing	% passed	-	**67.2**	**92.7**	**63.7**	**91**		**65.6**	**74.9**	**65.7**	**62.9**
SIEVE19KU	Sieve 19 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**93.4**	**100**
SIEVE8	Sieve 2.36 mm, Percent Passing	% passed	-	**76.8**	**94.7**	**82.4**	**91.3**		**86**	**76.6**	**69.4**	**69.3**
SIEVE3.35KU	Sieve 3.35 mm, Percent Passing	% passed	-	**79.7**	**95.3**	**84.2**	**95.7**		**88**	**83.3**	**73**	**78**
SIEVE37.5KU	Sieve 37.5 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**
SIEVE4	Sieve 4.75 mm, Percent Passing	% passed	-	**83.2**	**96**	**86.4**	**98.3**		**89.5**	**91.9**	**76.7**	**85.4**
SIEVE75KU	Sieve 75 mm, Percent Passing	% passed	-	**100**	**100**	**100**	**100**		**100**	**100**	**100**	**100**

NV - No value available.
[1]Screening criteria based on EPA Region III Freshwater Sediment Screening Benchmarks (EPA, 2006).
= Detected value exceeds screening criteria.

PARSONS

Table H-8: OU10 Groundwater Results – 2015

Source: 2015 Annual Report

TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:		Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells						Downgradient Shallow Bedrock Monitoring Wells						
		Location ID:		QPW-02	QPW-03R	MW-07	MW-08	11R	12R	13OR	13J	MW-05	11J	11J	12OR	13Z	13Z	13S
		Sampled:		07/23/15	07/21/15	07/23/15	07/25/15	07/23/15	07/14/15	07/23/15	07/15/15	07/24/15	07/23/15	07/23/15	07/23/15	07/23/15	07/24/15	07/26/15
		Validated:		11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15 Duplicate	11/26/15	11/26/15	11/26/15 Duplicate	11/26/15
CAS NO.	COMPOUND	UNITS:	Regional Screening Level[1]															
	VOLATILES																	
67-64-1	Acetone	ug/L	14000	**0.1**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
71-43-2	Benzene	ug/L	0.46	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-27-4	Bromodichloromethane	ug/L	0.13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-25-2	Bromoform	ug/L	3.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
74-83-9	Bromomethane	ug/L	7.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-93-3	Methyl Ethyl Ketone (2-Butanone)	ug/L	5600	**24**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.2 J**	5 U	5 U	5 U	5 U	5 U
75-15-0	Carbon Disulfide	ug/L	810	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**8.6**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
56-23-5	Carbon Tetrachloride	ug/L	0.46	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-90-7	Chlorobenzene	ug/L	78	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-00-3	Chloroethane	ug/L	21000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
67-66-3	Chloroform	ug/L	0.22	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
74-87-3	Chloromethane	ug/L	190	0.5 UJ	0.5 U	0.5 UJ	0.5 U	0.5 UJ	0.5 U	0.5 UJ	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 UJ	0.5 U	0.5 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-35-4	1,1-Dichloroethene	ug/L	280	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
156-59-2	Cis-1,2-Dichloroethylene	ug/L	36	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
156-60-5	Trans-1,2-Dichloroethene	ug/L	360	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-87-5	1,2-Dichloropropane	ug/L	0.44	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
10061-01-5	Cis-1,3-Dichloropropene	ug/L	0.47	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
10061-02-6	Trans-1,3-Dichloropropene	ug/L	0.47	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
100-41-4	Ethylbenzene	ug/L	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.2 J**	**0.2 J**	0.5 U	0.5 U	0.5 U	0.5 U
591-78-6	2-Hexanone	ug/L	38	**2.8 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
108-10-1	Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	ug/L	6300	5 UJ	5 U	5 UJ	5 U	5 UJ	5 U	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U
75-09-2	Methylene Chloride	ug/L	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
100-42-5	Styrene	ug/L	1200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
127-18-4	Tetrachloroethylene(PCE)	ug/L	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-88-3	Toluene	ug/L	1100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.3 J**	**0.2 J**	0.5 U	0.5 U	0.5 U	0.5 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
71-55-6	1,1,1-Trichloroethane	ug/L	8000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.28	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-01-6	Trichloroethylene (TCE)	ug/L	0.49	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-01-4	Vinyl Chloride	ug/L	0.019	0.5 U	0.5 U	**1.3**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1330-20-7	Xylene (Total)	ug/L	190	**0.1 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.8**	**1.3**	0.5 U	0.5 U	0.5 U	**0.5**
	SEMIVOLATILES																	
83-32-9	Acenaphthene	ug/L	530	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
208-96-8	Acenaphthylene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
120-12-7	Anthracene	ug/L	1800	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
56-55-3	Benzo(A)Anthracene	ug/L	0.012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
50-32-8	Benzo(A)Pyrene	ug/L	0.0034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
205-99-2	Benzo(B)Fluoranthene	ug/L	0.034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
191-24-2	Benzo(G,H,I)Perylene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
207-08-9	Benzo(K)Fluoranthene	ug/L	0.34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
101-55-3	4-Bromophenyl Phenyl Ether	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
85-68-7	Benzyl Butyl Phthalate	ug/L	16	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
86-74-8	Carbazole	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
59-50-7	4-Chloro-3-Methylphenol	ug/L	1400	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
106-47-8	4-Chloroaniline	ug/L	0.37	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
111-91-1	Bis(2-Chloroethoxy) Methane	ug/L	59	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
111-44-4	Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	ug/L	0.014	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-58-7	2-Chloronaphthalene	ug/L	750	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
95-57-8	2-Chlorophenol	ug/L	91	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7005-72-3	4-Chlorophenyl Phenyl Ether	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
218-01-9	Chrysene	ug/L	3.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).
[2] - Reported standard is for elemental mercury.
mS/cm = millisiemens per centimeter
NV - No Value Available
NTU = nephelometric turbidity unit
J = Estimated value
= Detected value exceeds RSL.
ug/L = micrograms per liter

Bold text indicates detected value.
U - Not detected, value indicates reporting limit.
R = Rejected
mV = millivolts
s.u = std. units
mg/L = milligrams per liter

PARSONS

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TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:		Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells						Downgradient Shallow Bedrock Monitoring Wells						
		Location ID		GPW-02	GPW-02R	MW-07	MW-08	118	128	130R	133	MW-05	119	119	120R	132	132	135
		Sampled: Validated:	Regional Screening	07/23/15 11/26/15	07/21/15 11/26/15	07/23/15 11/26/15	07/25/15 11/26/15	07/23/15 11/26/15	07/14/15 11/26/15	07/23/15 11/26/15	07/15/15 11/26/15	07/24/15 11/26/15	07/23/15 11/26/15	07/23/15 11/26/15 Duplicate	07/23/15 11/26/15	07/24/15 11/26/15	07/24/15 11/26/15 Duplicate	07/26/15 11/26/15
CAS NO.	COMPOUND	UNITS:	Level[1]															
53-70-3	Dibenz[A,H]Anthracene	ug/L	0.0034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
132-64-9	Dibenzofuran	ug/L	7.9	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
120-83-2	2,4-Dichlorophenol	ug/L	46	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
84-66-2	Diethyl Phthalate	ug/L	19000	5 U	**2 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
105-67-9	2,4-Dimethylphenol	ug/L	360	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
131-11-3	Dimethyl Phthalate	ug/L	NV	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
84-74-2	Di-N-Butyl Phthalate	ug/L	900	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
534-52-1	4,6-Dinitro-2-Methylphenol	ug/L	1.5	15 U	16 U	15 U	15 U	16 U	15 UR	15 U	15 U	15 U	15 U	15 U	16 U	15 U	15 U	15 U
51-28-5	2,4-Dinitrophenol	ug/L	39	30 U	32 U	30 U	30 U	31 U	30 UR	31 U	30 U	30 U	30 U	30 U	31 U	31 U	30 U	30 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
117-84-0	Di-N-Octylphthalate	ug/L	200	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	5.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
206-44-0	Fluoranthene	ug/L	800	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
86-73-7	Fluorene	ug/L	290	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.41	15 U	16 U	15 U	15 U	16 U	15 U	15 U	15 U	15 U	15 U	15 U	16 U	15 U	15 U	15 U
67-72-1	Hexachloroethane	ug/L	0.33	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
193-39-5	Indeno(1,2,3-C,D)Pyrene	ug/L	0.034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-59-1	Isophorone	ug/L	78	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-57-6	2-Methylnaphthalene	ug/L	36	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	930	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	1900	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene	ug/L	0.17	**0.1 J**	0.5 U	0.5 U	0.5 U	**0.3 J**	0.5 U	0.5 U	0.5 U	0.5 U	**0.4 J**	**0.3 J**	0.5 U	0.5 U	0.5 U	**0.1 J**
88-74-4	2-Nitroaniline	ug/L	190	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
99-09-2	3-Nitroaniline	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
100-01-6	4-Nitroaniline	ug/L	3.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
98-95-3	Nitrobenzene	ug/L	0.14	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
88-75-5	2-Nitrophenol	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
100-02-7	4-Nitrophenol	ug/L	NV	30 U	32 U	30 U	30 U	31 U	30 UR	31 U	30 U	30 U	30 U	30 U	31 U	31 U	30 U	30 U
621-64-7	N-Nitroso-di-N-Propylamine	ug/L	0.011	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
108-60-1	2,2'-Oxybis(1-chloropropane)	ug/L	710	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
87-86-5	Pentachlorophenol	ug/L	0.041	5 U	5 U	5 U	5 U	5 U	5 UR	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
85-01-8	Phenanthrene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-95-2	Phenol	ug/L	5800	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
129-00-0	Pyrene	ug/L	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
95-95-4	2,4,5-Trichlorophenol	ug/L	1200	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
88-06-2	2,4,6-Trichlorophenol	ug/L	4.1	1 U	1 U	1 U	1 U	1 U	1 UR	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
	METALS - DISSOLVED																	
7440-36-0	Antimony	ug/L	7.8	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 UJ	**4.6 J**	2 UJ	2 U	2 U	2 U
7440-38-2	Arsenic	ug/L	0.052	4 U	4 U	**0.63 J**	4 U	4 U	4 U	4 U	**30.7**	4 U	4 U	4 U	**0.91 J**	4 U	4 U	4 U
7440-41-7	Beryllium	ug/L	25	**0.19 J**	**0.077 J**	1 U	1 U	1 U	**0.071 J**	**0.098 J**	**0.13 J**	1 U	1 U	1 U	1 U	1 U	**0.36 J**	**0.16 J**
7440-43-9	Cadmium	ug/L	9.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	22000	**1.7 J**	4 U	4 U	4 U	4 U	4 U	4 U	**1.1 J**	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-50-8	Copper	ug/L	800	**3.2 J**	**0.87 J**	4 U	4 U	4 U	**0.46 J**	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7439-92-1	Lead	ug/L	15	2 U	**0.16 J**	**1.2 J**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7439-97-6	Mercury[2]	ug/L	0.63	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
7440-02-0	Nickel	ug/L	390	**19**	**23.6**	**1.1 J**	**1.5 J**	4 U	**1.1 J**	4 U	**18.4**	4 U	4 U	4 U	4 U	4 U	4 U	**1.6 J**
7782-49-2	Selenium	ug/L	100	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-28-0	Thallium	ug/L	0.20	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-62-2	Vanadium	ug/L	86	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.63 J**	1 U	1 U	1 U	1 U	**0.3 J**	1 U	1 U
7440-66-6	Zinc	ug/L	6000	**25.8 J**	**10.5 J**	30 U	30 U	30 U	30 U	30 U	30 U	**7.5 J**	30 U	30 U	30 U	30 U	30 U	30 U

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NTU = nephelometric turbidity unit
= Detected value exceeds RSL.
NV - No Value Available
J = Estimated value
ug/L = micrograms per liter

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R = Rejected
mV = millivolts
s.u = std. units
mg/L = miligrams per liter

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TABLE 12

OU-10 Viscose Basin 1-8 Groundwater Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 VB 1-8 Groundwater Wells		Purpose:		Upgradient Overburden Monitoring Wells		Upgradient Shallow Bedrock Monitoring Wells						Downgradient Shallow Bedrock Monitoring Wells						
		Location ID:		GPW-02	GPW-03R	MW-07	MW-08	118	128	130R	133	MW-05	119	119	120R	132	132	135
		Sampled:	Regional	07/23/15	07/21/15	07/23/15	07/25/15	07/23/15	07/14/15	07/23/15	07/15/15	07/24/15	07/23/15	07/23/15	07/23/15	07/24/15	07/24/15	07/24/15
		Validated:	Screening	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	Duplicate	11/26/15	11/26/15	11/26/15 Duplicate	11/26/15
CAS NO.	COMPOUND	UNITS:	Level[1]															
	FIELD PARAMETERS																	
	Temperature	°C	---	25.43	26.43	20.71	25.24	18.35	18.84	18.47	20.29	19.47	-	-	21.28	22	22	20.54
	Conductivity	mS/cm	---	0.4	0.7	1.4	1.3	1.1	1.3	0.7	7	0.7	-	-	0.5	2.3	2.3	2.8
	pH	s.u.	---	5.5	5.66	6.51	6.65	6.83	6.74	6.78	7.25	7.07	-	-	7.86	6.66	6.66	6.56
	ORP	mV	---	165.4	113.8	-8.84	-32.45	-40.4	-51.3	-31.72	-84.12	-64.76	-	-	-192.9	-42.23	-42.23	-31.86
	Turbidity	NTU	---	12.8	5.23	2.67	148	14.4	19.8	13.2	8.31	3.71	-	-	12.3	2.06	2.06	11.8
	Dissolved Oxygen	mg/L	---	2.61	1.06	0.05	0.1	0.08	0.12	0.1	0.11	0.05	-	-	0.05	0.06	0.06	0.08

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mV = millivolts
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mg/L = miligrams per liter

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TABLE 13

OU-10 New Landfill Groundwater Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 NLF Groundwater Wells		Purpose:		**Upgradient Overburden Monitoring Well**	**Upgradient Shallow Bedrock Monitoring Wells**		**Downgradient Shallow Bedrock Monitoring Wells**		
		Location ID:		GPW-03R	128	130R	MW-07	MW-08	133
		Sampled:	Regional	07/21/15	07/14/15	07/23/15	07/23/15	07/25/15	07/15/15
		Validated:	Screening	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15
CAS NO.	COMPOUND	UNITS:	Level[1]						
	VOLATILES								
67-64-1	Acetone	ug/L	14000	5 U	5 U	5 U	5 U	5 U	5 U
71-43-2	Benzene	ug/L	0.46	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-27-4	Bromodichloromethane	ug/L	0.13	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-25-2	Bromoform	ug/L	3.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
74-83-9	Bromomethane	ug/L	7.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-93-3	Methyl Ethyl Ketone (2-Butanone)	ug/L	5600	5 U	5 U	5 U	5 U	5 U	5 U
75-15-0	Carbon Disulfide	ug/L	810	1 U	1 U	1 U	1 U	1 U	**8.6**
56-23-5	Carbon Tetrachloride	ug/L	0.46	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-90-7	Chlorobenzene	ug/L	78	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-00-3	Chloroethane	ug/L	21000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
67-66-3	Chloroform	ug/L	0.22	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
74-87-3	Chloromethane	ug/L	190	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U	0.5 U
124-48-1	Dibromochloromethane	ug/L	0.87	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-35-4	1,1-Dichloroethene	ug/L	280	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
156-59-2	Cis-1,2-Dichloroethylene	ug/L	36	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
156-60-5	Trans-1,2-Dichloroethene	ug/L	360	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-87-5	1,2-Dichloropropane	ug/L	0.44	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
10061-01-5	Cis-1,3-Dichloropropene	ug/L	0.47	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
10061-02-6	Trans-1,3-Dichloropropene	ug/L	0.47	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
100-41-4	Ethylbenzene	ug/L	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
591-78-6	2-Hexanone	ug/L	38	5 U	5 U	5 U	5 U	5 U	5 U
108-10-1	Methyl Isobutyl Ketone (4-Methyl-2-Pentanone	ug/L	6300	5 U	5 U	5 UJ	5 UJ	5 U	5 U
75-09-2	Methylene Chloride	ug/L	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
100-42-5	Styrene	ug/L	1200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
127-18-4	Tetrachloroethylene(PCE)	ug/L	11	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-88-3	Toluene	ug/L	1100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
71-55-6	1,1,1-Trichloroethane	ug/L	8000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.28	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
79-01-6	Trichloroethylene (TCE)	ug/L	0.49	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
75-01-4	Vinyl Chloride	ug/L	0.019	0.5 U	0.5 U	0.5 U	**1.3**	0.5 U	0.5 U
1330-20-7	Xylene (Total)	ug/L	190	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
	SEMIVOLATILES								
83-32-9	Acenaphthene	ug/L	530	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
208-96-8	Acenaphthylene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
120-12-7	Anthracene	ug/L	1800	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
56-55-3	Benzo(A)Anthracene	ug/L	0.012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
50-32-8	Benzo(A)Pyrene	ug/L	0.0034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
205-99-2	Benzo(B)Fluoranthene	ug/L	0.034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
191-24-2	Benzo(G,H,I)Perylene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
207-08-9	Benzo(K)Fluoranthene	ug/L	0.34	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
101-55-3	4-Bromophenyl Phenyl Ether	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U
85-68-7	Benzyl Butyl Phthalate	ug/L	16	5 U	5 U	5 U	5 U	5 U	5 U
86-74-8	Carbazole	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U
59-50-7	4-Chloro-3-Methylphenol	ug/L	1400	1 U	1 UR	1 U	1 U	1 U	1 U
106-47-8	4-Chloroaniline	ug/L	0.37	4 U	4 U	4 U	4 U	4 U	4 U
111-91-1	Bis(2-Chloroethoxy) Methane	ug/L	59	1 U	1 U	1 U	1 U	1 U	1 U
111-44-4	Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	ug/L	0.014	1 U	1 U	1 U	1 U	1 U	1 U
91-58-7	2-Chloronaphthalene	ug/L	750	1 U	1 U	1 U	1 U	1 U	1 U
95-57-8	2-Chlorophenol	ug/L	91	1 U	1 UR	1 U	1 U	1 U	1 U

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TABLE 13

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Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 NLF Groundwater Wells		Purpose:		Upgradient Overburden Monitoring Well	Upgradient Shallow Bedrock Monitoring Wells		Downgradient Shallow Bedrock Monitoring Wells		
		Location ID:		GPW-03R	128	130R	MW-07	MW-08	133
		Sampled:	Regional	07/21/15	07/14/15	07/23/15	07/23/15	07/25/15	07/15/15
		Validated:	Screening	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15
CAS NO.	COMPOUND	UNITS:	Level[1]						
7005-72-3	4-Chlorophenyl Phenyl Ether	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U
218-01-9	Chrysene	ug/L	3.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
53-70-3	Dibenz(A,H)Anthracene	ug/L	0.0034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
132-64-9	Dibenzofuran	ug/L	7.9	1 U	1 U	1 U	1 U	1 U	1 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	1 U	1 U	1 U	1 U	1 U	1 U
541-73-1	1,3-Dichlorobenzene	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	1 U	1 U	1 U	1 U	1 U	1 U
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	5 U	5 U	5 U	5 U	5 U	5 U
120-83-2	2,4-Dichlorophenol	ug/L	46	1 U	1 UR	1 U	1 U	1 U	1 U
84-66-2	Diethyl Phthalate	ug/L	15000	**2 J**	5 U	5 U	5 U	5 U	5 U
105-67-9	2,4-Dimethylphenol	ug/L	360	1 U	1 UR	1 U	1 U	1 U	1 U
131-11-3	Dimethyl Phthalate	ug/L	NV	5 U	5 U	5 U	5 U	5 U	5 U
84-74-2	Di-N-Butyl Phthalate	ug/L	900	5 U	5 U	5 U	5 U	5 U	5 U
534-52-1	4,6-Dinitro-2-Methylphenol	ug/L	1.5	16 U	15 UR	15 U	15 U	15 U	15 U
51-28-5	2,4-Dinitrophenol	ug/L	39	32 U	30 UR	31 U	30 U	30 U	30 U
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	5 U	5 U	5 U	5 U	5 U	5 U
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	1 U	1 U	1 U	1 U	1 U	1 U
117-84-0	Di-N-Octylphthalate	ug/L	200	5 U	5 U	5 U	5 U	5 U	5 U
117-81-7	Bis(2-Ethylhexyl) Phthalate	ug/L	5.6	5 U	5 U	5 U	5 U	5 U	5 U
206-44-0	Fluoranthene	ug/L	800	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
86-73-7	Fluorene	ug/L	290	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
87-68-3	Hexachlorobutadiene	ug/L	0.14	1 U	1 U	1 U	1 U	1 U	1 U
118-74-1	Hexachlorobenzene	ug/L	0.0098	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
77-47-4	Hexachlorocyclopentadiene	ug/L	0.41	16 U	15 U	15 U	15 U	15 U	15 U
67-72-1	Hexachloroethane	ug/L	0.33	5 U	5 U	5 U	5 U	5 U	5 U
193-39-5	Indeno(1,2,3-C,D)Pyrene	ug/L	0.034	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
78-59-1	Isophorone	ug/L	78	1 U	1 U	1 U	1 U	1 U	1 U
91-57-6	2-Methylnaphthalene	ug/L	36	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
95-48-7	2-Methylphenol (O-Cresol)	ug/L	930	1 U	1 UR	1 U	1 U	1 U	1 U
106-44-5	4-Methylphenol (P-Cresol)	ug/L	1900	1 U	1 U	1 U	1 U	1 U	1 U
91-20-3	Naphthalene	ug/L	0.17	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
88-74-4	2-Nitroaniline	ug/L	190	1 U	1 U	1 U	1 U	1 U	1 U
99-09-2	3-Nitroaniline	ug/L	NV	1 U	1 U	1 U	1 U	1 U	1 U
100-01-6	4-Nitroaniline	ug/L	3.8	1 U	1 U	1 U	1 U	1 U	1 U
98-95-3	Nitrobenzene	ug/L	0.14	1 U	1 U	1 U	1 U	1 U	1 U
88-75-5	2-Nitrophenol	ug/L	NV	1 U	1 UR	1 U	1 U	1 U	1 U
100-02-7	4-Nitrophenol	ug/L	NV	32 U	30 UR	31 U	30 U	30 U	30 U
621-64-7	N-Nitrosodi-N-Propylamine	ug/L	0.011	1 U	1 U	1 U	1 U	1 U	1 U
86-30-6	N-Nitrosodiphenylamine	ug/L	12	1 U	1 U	1 U	1 U	1 U	1 U
108-60-1	2,2'-Oxybis(1-chloropropane)	ug/L	710	1 U	1 U	1 U	1 U	1 U	1 U
87-86-5	Pentachlorophenol	ug/L	0.041	5 U	5 UR	5 U	5 U	5 U	5 U
85-01-8	Phenanthrene	ug/L	NV	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
108-95-2	Phenol	ug/L	5800	1 U	1 UR	1 U	1 U	1 U	1 U
129-00-0	Pyrene	ug/L	120	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	1 U	1 U	1 U	1 U	1 U	1 U
95-95-4	2,4,5-Trichlorophenol	ug/L	1200	1 U	1 UR	1 U	1 U	1 U	1 U
88-06-2	2,4,6-Trichlorophenol	ug/L	4.1	1 U	1 UR	1 U	1 U	1 U	1 U
	METALS - DISSOLVED								
7440-36-0	Antimony	ug/L	7.8	2 U	2 U	2 UJ	2 UJ	2 U	2 U
7440-38-2	Arsenic	ug/L	0.052	4 U	4 U	4 U	**0.63 J**	4 U	**30.7**
7440-41-7	Beryllium	ug/L	25	**0.077 J**	**0.071 J**	**0.098 J**	1 U	1 U	**0.13 J**
7440-43-9	Cadmium	ug/L	9.2	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	22000	4 U	4 U	4 U	4 U	4 U	**1.1 J**
7440-50-8	Copper	ug/L	800	**0.87 J**	**0.46 J**	4 U	4 U	4 U	4 U
7439-92-1	Lead	ug/L	15	**0.16 J**	2 U	2 U	**1.2 J**	2 U	2 U
7439-97-6	Mercury[2]	ug/L	0.63	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).
[2] - Reported standard is for elemental mercury.
mS/cm = milisiemens per centimeter
NTU = nephelometric turbidity unit
= Detected value exceeds RSL.
NV - No Value Available
J = Estimated value
ug/L = micrograms per liter

Bold text indicates detected value.
U - Not detected, value indicates reporting limit.
R = Rejected
mV = millivolts
s.u = std. units
mg/L = miligrams per liter

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TABLE 13

OU-10 New Landfill Groundwater Monitoring Network Sampling Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event OU-10 NLF Groundwater Wells		Purpose:		**Upgradient Overburden Monitoring Well**	**Upgradient Shallow Bedrock Monitoring Wells**		**Downgradient Shallow Bedrock Monitoring Wells**		
		Location ID:		GPW-03R	128	130R	MW-07	MW-08	133
		Sampled:	Regional	07/21/15	07/14/15	07/23/15	07/23/15	07/25/15	07/15/15
		Validated:	Screening	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15	11/26/15
CAS NO.	COMPOUND	UNITS:	Level[1]						
7440-02-0	Nickel	ug/L	390	**23.6**	**1.1 J**	4 U	**1.1 J**	**1.5 J**	**18.4**
7782-49-2	Selenium	ug/L	100	4 U	4 U	4 U	4 U	4 U	4 U
7440-28-0	Thallium	ug/L	0.20	1 U	1 U	1 U	1 U	1 U	1 U
7440-62-2	Vanadium	ug/L	86	1 U	1 U	1 U	1 U	1 U	**0.63 J**
7440-66-6	Zinc	ug/L	6000	**10.5 J**	30 U	30 U	30 U	30 U	30 U
	FIELD PARAMETERS								
	Temperature	°C	---	26.43	18.84	18.47	20.71	25.24	20.29
	Conductivity	mS/cm	---	0.7	1.3	0.7	1.4	1.3	7
	pH	s.u.	---	5.66	6.74	6.78	6.51	6.65	7.25
	ORP	mV	---	113.79	-51.3	-31.72	-8.84	-32.45	-84.12
	Turbidity	NTU	---	5.23	19.8	13.2	2.67	148	8.31
	Dissolved Oxygen	mg/L	---	1.06	0.12	0.1	0.05	0.1	0.11

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).
[2] - Reported standard is for elemental mercury.
mS/cm = milisiemens per centimeter
NTU = nephelometric turbidity unit
= Detected value exceeds RSL.
NV - No Value Available
J = Estimated value
ug/L = micrograms per liter
Bold text indicates detected value.
U - Not detected, value indicates reporting limit.
R = Rejected
mV = millivolts
s.u = std. units
mg/L = miligrams per liter

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Table H-9: NTCRA Basin Groundwater Results – 2015

Source: 2015 Annual Report

TABLE 16

NTCRA Basins Groundwater Monitoring Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated BSN Wells		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Regional Screening Level[1]	008 7979529 OMW AVX07 7/22/2015 14:10 11/26/2015	012 7998202 OMW AVX18 8/5/2015 16:55 11/26/2015	13 7984569 OMW AVX15 7/28/2015 15:40 11/26/2015	014R 7981289 OMW AVX11 7/26/2015 15:20 11/26/2015	022 7998203 OMW AVX18 8/5/2015 15:00 11/26/2015	023 7998204 OMW AVX18 8/5/2015 14:00 11/26/2015	025R 7984570 OMW AVX15 7/29/2015 8:45 11/26/2015
CAS NO.	COMPOUND	UNITS:								
	METALS - DISSOLVED									
7440-38-2	Arsenic	ug/L	0.052	**0.95 J**	4 U	**1.6 J**	**692**	**1.8 J**	**2.3 J**	**1.9 J**
7440-41-7	Beryllium	ug/L	25	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-43-9	Cadmium	ug/L	9.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	22000	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-50-8	Copper	ug/L	800	**0.7 J**	4 U	4 U	4 U	4 U	4 U	**4.4**
7439-92-1	Lead	ug/L	15	2 U	2 U	2 U	**0.16 J**	2 U	2 U	2 U
7439-97-6	Mercury[2]	ug/L	0.63	0.2 U	0.2 UJ-	0.2 U	0.2 U	0.2 UJ-	0.2 UJ-	0.2 U
7440-02-0	Nickel	ug/L	390	**6.6**	**2.3 J**	**20.6**	**64**	**9.3**	**3.8 J**	**2.5 J**
7782-49-2	Selenium	ug/L	100	4 U	4 U	4 U	4 U	**0.77 J**	**0.76 J**	4 U
7440-66-6	Zinc	ug/L	6000	30 U	30 U	30 U	30 U	30 U	30 U	30 U
	OTHER									
7440-70-2	Calcium, Dissolved	ug/L	NV	**229000**	**165000**	**254000**	**384000 J**	**213000**	**77300**	**68800**
7439-95-4	Magnesium, Dissolved	ug/L	NV	**27000**	**23400**	**33900**	**120000 J**	**40900**	**103000**	**10600**
7440-23-5	Sodium, Dissolved	ug/L	NV	**14000**	**33500**	**62900**	**787000**	**750000**	**364000**	**3920**
16887-00-6	Chloride (As Cl)	mg/L	NV	**28.7**	**45**	**34.3**	**116**	**71.2**	**23.3**	**9.5**
14808-79-8	Sulfate (As SO4)	mg/L	NV	**283**	**336**	**586**	**2540 J**	**1050**	**643**	**24.8**
	FIELD PARAMETERS									
	Temperature	°C	---	20.38	22.95	20.38	24.41	28.35	33.25	24.1
	Conductivity	mS/cm	---	1.133	1.125	1.7	5.6	4.1	2.5	0.5
	pH	s.u.	---	6.75	7.09	6.56	6.72	6.95	7.14	6.78
	ORP	mV	---	71.1	163.28	0.89	-21.84	-69.8	42.1	24
	Turbidity	NTU	---	68.6	87	161	55.7	9.77	22.9	42.7
	Dissolved Oxygen	mg/L	---	3.65	0.13	0.06	0.02	1.68	3.62	0.43

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).

[2] - Reported standard is for elemental mercury.

Bold text indicates detected value

U - Not detected, value indicates reporting limit

J = Estimated value (+ high bias - low bias)

NV - No Value Available

= Detected value exceeds RSL.

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TABLE 16

NTCRA Basins Groundwater Monitoring Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated BSN Wells		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Regional Screening Level[1]	029 7981290 OMW AVX11 7/26/2015 12:45 11/26/2015	108 7979530 S BMW AVX07 7/22/2015 13:55 11/26/2015	110 7979531 S BMW AVX07 7/24/2015 11:10 11/26/2015	112 7998205 S BMW AVX18 8/5/2015 14:45 11/26/2015	113 7984572 S BMW AVX15 7/28/2015 17:10 11/26/2015	114 7993583 S BMW AVX16 8/5/2015 11:30 11/26/2015	129 7981292 S BMW AVX11 7/26/2015 10:45 11/26/2015
CAS NO.	COMPOUND	UNITS:								
	METALS - DISSOLVED									
7440-38-2	Arsenic	ug/L	0.052	4 U	4 U	4 U	4 U	**0.75 J**	**2.8 J**	**0.93 J**
7440-41-7	Beryllium	ug/L	25	1 U	1 U	1 U	**0.15 J**	1 U	**0.29 J**	1 U
7440-43-9	Cadmium	ug/L	9.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	22000	4 U	4 U	4 U	4 U	4 U	4 U	4 U
7440-50-8	Copper	ug/L	800	4 U	4 U	4 U	4 U	**0.45 J**	4 U	4 U
7439-92-1	Lead	ug/L	15	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7439-97-6	Mercury[2]	ug/L	0.63	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 U	0.2 UJ-	0.2 U
7440-02-0	Nickel	ug/L	390	**2.9 J**	4 U	**21.1**	**6.3**	**1.7 J**	**82.6**	**1.1 J**
7782-49-2	Selenium	ug/L	100	**1.5 J**	4 U	4 U	4 U	4 U	4 U	4 U
7440-66-6	Zinc	ug/L	6000	30 U	30 U	30 U	**80.5**	**11.5 J**	30 U	30 U
	OTHER									
7440-70-2	Calcium, Dissolved	ug/L	NV	**138000 J**	**189000**	**185000**	**362000**	**319000**	**466000**	**239000 J**
7439-95-4	Magnesium, Dissolved	ug/L	NV	**17500 J**	**16700**	**32600**	**49400**	**37700**	**100000**	**28000 J**
7440-23-5	Sodium, Dissolved	ug/L	NV	**49400**	**13600**	**266000**	**73200**	**33500**	**251000**	**25800**
16887-00-6	Chloride (As Cl)	mg/L	NV	**40**	**14**	**21.3**	**53.4**	**36.8**	**96.1**	**67.8**
14808-79-8	Sulfate (As SO4)	mg/L	NV	**321 J**	**259**	**759**	**928**	**676**	**1420**	**415 J**
	FIELD PARAMETERS									
	Temperature	°C	---	18.75	24.89	18.79	18.97	19.88	21.77	21.95
	Conductivity	mS/cm	---	1.1	0.9	2.1	2.2	1.7	3.3	1.4
	pH	s.u.	---	6.19	7.21	7.1	6.81	7.19	6.49	6.97
	ORP	mV	---	290.09	-111.15	-71.5	61.16	-100.55	7.1	68.99
	Turbidity	NTU	---	4.52	108	53.6	2	90.8	8.96	2.85
	Dissolved Oxygen	mg/L	---	0.84	0.11	0.15	0	0.08	0.33	0.5

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).

[2] - Reported standard is for elemental mercury.

Bold text indicates detected value

U - Not detected, value indicates reporting limit

J = Estimated value (+ high bias - low bias)

NV - No Value Available

= Detected value exceeds RSL.

TABLE 16

NTCRA Basins Groundwater Monitoring Results
2015 Annual Site-Wide Groundwater, Surface Water, and Sediment Monitoring Report for OU-7, OU-10, and NTCRA Basins
Avtex Fibers Superfund Site
Front Royal, Virginia

FMC-Front Royal Avtex Fibers 2015 Sampling Event Validated BSN Wells		Location ID: Lab Sample Id: Well Type: SDG: Sampled: Validated:	Regional Screening Level[1]	132 7981293 S BMW AVX11 7/24/2015 14:40 11/26/2015	132 (DUP) 7981297 S BMW AVX11 7/24/2015 14:40 11/26/2015	B-48A 7979542 OMW AVX07 7/24/2015 9:35 11/26/2015	MW-12 7981307 OMW AVX11 7/25/2015 14:20 11/26/2015	PZ-03 7998211 S BMW AVX18 8/5/2015 17:30 11/26/2015	PZ-06 7993589 S BMW AVX16 8/4/2015 15:10 11/26/2015	PZ-07 7993590 S BMW AVX16 8/4/2015 16:40 11/26/2015
CAS NO.	COMPOUND	UNITS:								
	METALS - DISSOLVED									
7440-38-2	Arsenic	ug/L	0.052	4 U	4 U	4 U	**55.2**	4 U	**8.2**	**4.6**
7440-41-7	Beryllium	ug/L	25	1 U	**0.36 J**	1 U	1 U	**0.12 J**	1 U	**0.09 J**
7440-43-9	Cadmium	ug/L	9.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U
7440-47-3	Chromium	ug/L	22000	4 U	4 U	4 U	**1.1 J**	4 U	4 U	**1.3 J**
7440-50-8	Copper	ug/L	800	4 U	4 U	**0.63 J**	11.1 U	4 U	4 U	4 U
7439-92-1	Lead	ug/L	15	2 U	2 U	2 U	**0.72 J**	2 U	2 U	2 U
7439-97-6	Mercury[2]	ug/L	0.63	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ-	0.2 UJ-	0.2 UJ-
7440-02-0	Nickel	ug/L	390	4 U	4 U	**58.5**	**17.4**	**4.2**	**7.4**	**33.8**
7782-49-2	Selenium	ug/L	100	4 U	4 U	4 U	**1.3 J**	**0.56 J**	4 U	4 U
7440-66-6	Zinc	ug/L	6000	30 U	30 U	30 U	30 U	30 U	30 U	30 U
	OTHER									
7440-70-2	Calcium, Dissolved	ug/L	NV	**307000 J**	**294000 J**	**199000**	**37900 J**	**475000**	**59700**	**345000**
7439-95-4	Magnesium, Dissolved	ug/L	NV	**44900 J**	**43400 J**	**22800**	**23200 J**	**139000**	**60700**	**58100**
7440-23-5	Sodium, Dissolved	ug/L	NV	**153000**	**163000**	**190000**	**3460000**	**997000**	**426000**	**234000**
16887-00-6	Chloride (As Cl)	mg/L	NV	**120**	**66.8**	**25.9**	**375**	**122**	**50.3**	**73.4**
14808-79-8	Sulfate (As SO4)	mg/L	NV	**713 J**	**721 J**	**600**	**4590 J**	**2510**	**545**	**1080**
	FIELD PARAMETERS									
	Temperature	°C	---	22	22	17.49	26.99	20.17	20.95	20.74
	Conductivity	mS/cm	---	2.3	2.3	1.9	14.1	6.4	2.4	2.6
	pH	s.u.	---	6.66	6.66	6.95	8.19	6.78	7.51	6.94
	ORP	mV	---	-42.23	-42.23	28.34	234.3	-26.35	15.57	-9.4
	Turbidity	NTU	---	2.06	2.06	37.1	16.7	31.3	6.48	1.09
	Dissolved Oxygen	mg/L	---	0.06	0.06	0.21	0.45	0.13	0.39	0.17

[1] - EPA Regional Screening Levels (RSLs) for tapwater (November 2015).

[2] - Reported standard is for elemental mercury.

Bold text indicates detected value

U - Not detected, value indicates reporting limit

J = Estimated value (+ high bias - low bias)

NV - No Value Available

= Detected value exceeds RSL.

Table H-10: Influent Leachate Sampling Summary 2015-2016

Source: 2016 SITE-WIDE O&M REPORT

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	TW-01			TW-02				
		7/24/2015	12/9/2015	8/9/2016	7/23/2015	DUP	12/9/2015	8/9/2016	7/23/2015
Carbon Disulfide	ug/L	1,200	360	190	3,100	NR	3,600	847	9
Antimony	mg/L	0.0129	0.0055	0.00282 U^B	0.0174	0.0165	0.0125	0.00478 ^ B	< 0.0017
Arsenic	mg/L	0.0847	0.0482	0.0157	0.0886	0.0942	0.0102	0.0296	< 0.0027
Iron	mg/L	< 0.115	0.427	0.386	< 0.115	< 0.115	0.309	0.0513	0.307 J
Kjeldahyl Nitrogen	mg/L	2.9 J	0.83 J	NR	3.3 J	3.4 J	2.0	NR	< 2.5
Total Nitrite/Nitrate Nitrogen	mg/L	<0.40	<0.40	NR	<0.40	<0.40	<0.40	NR	<0.40
Total Nitrogen (NO2/NO3/TKN)	mg/L	2.9 J	0.83 J	2.68	3.3 J	3.4 J	2.0	1.03	< 2.5
Total Phosphorous as P	mg/L	1.3	0.98	0.576	1.65	1.6	1.8	0.824	< 0.050
Chemical Oxygen Demand (COD)	mg/L	368	287	120	375	386	483.0	212	18.5 J
Soluble COD	mg/L	247	300	125	408	391	522	137	20.8 J
Total Alkalinity	mg/L as CaCO3	858	898	478	1,460	1,470	2,100	877	176
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	11.5	NR	NR	NR	37.9	NR
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	466	NR	NR	NR	839	NR
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	NR	< 5.00	NR
Total Disolved Solids (TDS)	mg/L	1,880	1,500	957	3,620	3,350	3,540	1,780	384
Disolved Sulfide	mg/L	190	127	29.6	221	212	221	39	6.8
Sulfide as H2S	mg/L	3.8	< 5.4	NR	11	11	2.2	NR	0.54
Un-ionized H2S	mg/L	NR	NR	4.97	NR	NR	NR	6.60	NR
Biological Oxygen Demand (BOD)	mg/L	242	135	82.6	227	227	204	114	9.3
Soluble BOD	mg/L	194	101	76.0	144	143	139	108	7.4
Density	--	0.998	0.998	0.999	0.995	0.997	0.997	0.999	0.994
Specific Conductance	umhos/cm	3,260	2,230	1,580	7,470	7,490	5,850	2,580	726
pH	Std. Units	8.9	9.2	8.47	8.3	8.3	9.0		8.1
Temerature of pH	Deg. C	NR	19.7	NR	NR	NR	19.7	NR	NR

NR = Not Reported
NS = Not Sampled
J = Estimated Value
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	TW-03			VB-09			VB-10	
		12/9/2015	DUP	8/9/2016	7/24/2015	12/9/2015	8/8/2016	7/24/2015	12/9/2015
Carbon Disulfide	ug/L	2 J	NR	1.26	33,000	5,400	5320 J	210,000	5,200
Antimony	mg/L	< 0.00033	< 0.00033	0.000911 UJ^B	0.0152	0.0038	0.0106 J ^ B	0.043	0.0032
Arsenic	mg/L	< 0.00054	< 0.00054	< 0.000500	0.0198	0.0116	0.00880 J	0.0896	0.063
Iron	mg/L	0.0524 J	0.0488 J	0.273	0.612 J	3.9	0.832	0.454 J	0.194 J
Kjeldahyl Nitrogen	mg/L	< 0.50	0.52 J	NR	20.1	< 25.0	NR	10.3	< 25.0
Total Nitrite/Nitrate Nitrogen	mg/L	0.046 J	<0.40	NR	< 0.80	<0.40	NR	1.9	< 0.40
Total Nitrogen (NO2/NO3/TKN)	mg/L	< 0.50	0.52 J	0.499	20.1	< 25.0	10.3	12.2	< 25.0
Total Phosphorous as P	mg/L	< 0.050	< 0.050	< 0.0500	5.8	0.44 J	0.299	0.2	1.0
Chemical Oxygen Demand (COD)	mg/L	28.7 J	31.0 J	27.6	8,070	3,820	2850 J	1,960	2,840
Soluble COD	mg/L		28.7 J	28.4	8,090	3,450	3570 J	1,360	2,810
Total Alkalinity	mg/L as CaCO3	267	269	257	9,250	5,230	< 5.00	5,920	5,280
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	< 5.00	NR	NR
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	257	NR	NR	< 5.00	NR	NR
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	< 5.00	NR	NR
Total Disolved Solids (TDS)	mg/L	740	739	736	15,700	6,880	7,220	10,100	7,560
Disolved Sulfide	mg/L	8.2	8.6	3.79	1,560	447	< 0.50	706	155
Sulfide as H2S	mg/L	0.98	0.86	NR	234	22	NR	< 0.054	10.9
Un-ionized H2S	mg/L	NR	NR	< 0.100	NR	NR	< 0.100	NR	NR
Biological Oxygen Demand (BOD)	mg/L	10.6	9.9	10.2	5,000	1,890	1,970 JH	1,110	1,710
Soluble BOD	mg/L	6.9	7.5	6.74	4,240	1,710	1,930 JH	955	1,370
Density	--	0.995	0.994	0.998	1.00	0.999	1.04	1.00	1.00
Specific Conductance	umhos/cm	1,130	1,130	1,130	20,700	11,300	8,180	14,900	11,700
pH	Std. Units	7.9	8.0	6.98	7.7	8.3	7.61	9.1	8.1
Temerature of pH	Deg. C	21.2	21.1	NR	NR	19.2	NR	NR	19.3

NR = Not Reported
NS = Not Sampled
J = Estimated Value
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units		VB-11		
		8/9/2016	7/24/2015	12/9/2015	8/9/2016
Carbon Disulfide	ug/L	185	110	NS	45.8
Antimony	mg/L	0.0131 J ^ B	< 0.00066	NS	0.00706 J ^ B
Arsenic	mg/L	0.0769	0.0286	NS	0.0314
Iron	mg/L	0.644	0.879 J	NS	4.46
Kjeldahyl Nitrogen	mg/L	NR	4.1 J	NS	NR
Total Nitrite/Nitrate Nitrogen	mg/L	NR	< 0.80	NS	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	5.5	4.1 J	NS	1.19
Total Phosphorous as P	mg/L	1.53	1.0	NS	0.4
Chemical Oxygen Demand (COD)	mg/L	897	205	NS	1,240
Soluble COD	mg/L	508	25.4 J	NS	137
Total Alkalinity	mg/L as CaCO3	< 5.00	1,840	NS	1,350
Carbonate Alkalinity	mg/L as CaCO3	< 5.00	NR	NS	< 5.00
Bicarbonate Alkalinity	mg/L as CaCO3	< 5.00	NR	NS	1,350
Hydrxide Alkalinity	mg/L as CaCO3	< 5.00	NR	NS	< 5.00
Total Disolved Solids (TDS)	mg/L	7,930	2,260	NS	1,720
Disolved Sulfide	mg/L	11.7	30.8	NS	5
Sulfide as H2S	mg/L	NR	12.0	NS	
Un-ionized H2S	mg/L	4.09	NR	NS	0.784 J
Biological Oxygen Demand (BOD)	mg/L	342	47.5	NS	49.1
Soluble BOD	mg/L	72.0	< 5.7	NS	11.7
Density	--	1.01	0.996	NS	1.03
Specific Conductance	umhos/cm	99,30	3,990	NS	2,600
pH	Std. Units	8.07	7.2	NS	7
Temerature of pH	Deg. C	NR		NS	NR

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B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	LS-01			LS-02		
		7/28/2016	12/9/2015	8/9/2016	7/28/2015	12/9/2015	8/9/2016
Carbon Disulfide	ug/L	< 1	< 1	4.10	36	7	16.8
Antimony	mg/L	0.00096 J	0.00043 J	0.00843 J ^ B	0.00088 J	0.00072 J	0.0102 J ^ B
Arsenic	mg/L	0.0512	0.0177	0.117	0.0377	0.0673	0.199
Iron	mg/L	4.91	1.74	11.9	0.364	0.0909 J	0.275
Kjeldahyl Nitrogen	mg/L	2.8	0.99 J	NR	1.2	1.2	NR
Total Nitrite/Nitrate Nitrogen	mg/L	0.053 J	< 0.40	NR	0.13	< 0.40	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	2.9	0.99 J	3.05	1.3	1.2	2.19
Total Phosphorous as P	mg/L	1.5	0.32	1.09	1.0	2.2	4.12
Chemical Oxygen Demand (COD)	mg/L	143	58.1	206	73.7	135	238
Soluble COD	mg/L	152	62.7	196	87.5	149	235
Total Alkalinity	mg/L as CaCO3	2,590	1,320	< 5.00	1,280	2,340	< 5.00
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	434
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	< 5.00
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	<5.00
Total Disolved Solids (TDS)	mg/L	4,640	2,110	6,830	2,010	3,480	7,710
Disolved Sulfide	mg/L	< 0.054	< 0.054	0.564 J	< 0.054	< 0.054	3.06
Sulfide as H2S	mg/L	<0.054	< 0.054	NR	< 0.054	< 0.054	NR
Un-ionized H2S	mg/L	NR	NR	1.96	NR	NR	0.512 J
Biological Oxygen Demand (BOD)	mg/L	9.2	< 6.0	10.6	< 5.6	6.1	5.18
Soluble BOD	mg/L	< 8.1	< 5.8	3.93	< 4.7	< 6.0	4.06
Density	--	1.00	0.996	1.04	0.998	0.996	1.01
Specific Conductance	umhos/cm	7,400	3,870	8,560	3,950	6,670	10,100
pH	Std. Units	7.3	8	7.27	8.6	9.1	8.9
Temerature of pH	Deg. C	NR	19.8	NR	NR	19.7	NR

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F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

TABLE 7

Summary of Influent Sampling
Avtex Fibers Superfund Site
Front Royal, Virginia

Constituent	Units	LS-03			LS-04			
		7/28/2015	12/9/2015	8/9/2016	7/28/2015	12/9/2015	8/9/2016	DUP
Carbon Disulfide	ug/L	< 1	< 1	0.284 J	25	14	27.4	25.6
Antimony	mg/L	< 0.00033	< 0.00033	0.000976 UJ^B	< 0.00033	< 0.00033	0.00120 UJ^B	0.00103 UJ^B
Arsenic	mg/L	0.0020 J	0.0017 J	0.00134 J	0.0106	0.0071	0.00775	0.00779
Iron	mg/L	11.0	4.89	16.4	1.08	0.896	0.392 J F1	1.67 J
Kjeldahyl Nitrogen	mg/L	5.6	2.7	NR	4.6	1.4	NR	NR
Total Nitrite/Nitrate Nitrogen	mg/L	< 0.040	< 0.040	NR	< 0.040	< 0.040	NR	NR
Total Nitrogen (NO2/NO3/TKN)	mg/L	5.6	2.7	4.62	4.6	1.4	4.74	5.16
Total Phosphorous as P	mg/L	1.5	0.54	1.48	0.62	0.67	0.991 F1	1.02
Chemical Oxygen Demand (COD)	mg/L	39.2	40.0 J	45.9	193	64.9	199	195
Soluble COD	mg/L	48.4 J	49.1 J	40.8	205	71.7	37.2	196
Total Alkalinity	mg/L as CaCO3	554	664	623	1,460	732	1,200	1,210
Carbonate Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	< 5.00	< 5.00
Bicarbonate Alkalinity	mg/L as CaCO3	NR	NR	623	NR	NR	1,200	1,210
Hydrxide Alkalinity	mg/L as CaCO3	NR	NR	< 5.00	NR	NR	< 5.00	< 5.00
Total Disolved Solids (TDS)	mg/L	1,920	1,350	1,220	3,830	1,680	2,830	2,730
Disolved Sulfide	mg/L	0.10 J	< 0.054	< 0.500	7	3.3	17.8	24.4
Sulfide as H2S	mg/L	0.080 J	< 0.054	NR	3.1	0.83	NR	NR
Un-ionized H2S	mg/L	NR	NR	< 0.100	NR	NR	2.98	3.11
Biological Oxygen Demand (BOD)	mg/L	10.4	8.5	11.8	14.3	6.0	39.2 J	122 J
Soluble BOD	mg/L	< 3.8	< 6.0	3.03	< 9.9	< 5.9	37.2	42.5
Density	--	0.998	0.996	1.03	1.00	0.996	1.03	1.00
Specific Conductance	umhos/cm	2,980	2,220	1,870	6,560	2,900	3,750	3,810
pH	Std. Units	6.5	7.2	6.52	7.1	7.5	7.34	7.34
Temerature of pH	Deg. C	NR	19.8	NR	NR	19.6	NR	NR

NR = Not Reported
NS = Not Sampled
J = Estimated Value
^ = Instrument related QC is outside acceptable limits
B = Constituent Detected in Blank Sample
F1 = MS and/or MSD recovery outside acceptable limits
H = Holding time exceeded

APPENDIX I – DETAILED ARARs REVIEW

This FYR evaluates the chemical-specific applicable or relevant and appropriate requirements (ARARs) identified in site decision documents to determine if changes in chemical-specific standards affect the protectiveness of the Site's remedy.

OU2
The OU2 ROD, issued in 1990, identified EPA's Guidance on Remedial Action for Superfund Sites with PCB Contamination [EPA/540/G-90/007] and the Toxic Substances and Control Act (TSCA) PCB Cleanup Policy, 40 CFR 61, Subpart G as to-be-considered criteria for the PCB cleanup. The OU2 ROD selected a soil cleanup level of 10 ppm (or 10 mg/kg) based on recommendations in the guidance.

In 1999, EPA promulgated the TSCA rule at 40 CFR §761.61 which identifies cleanup levels for PCB remediation waste based on the kind of material and the potential exposure to PCBs left after cleanup is completed. Although the TSCA standards are not binding under CERCLA cleanups [see 40 CFR §761.61(a)(1)(ii)], EPA considers them relevant and appropriate. Under the TSCA rule soil is considered a bulk PCB remediation waste and a cleanup level of less than or equal to 25 ppm would be appropriate for a low occupancy area (i.e., industrial/commercial use). This cleanup level is less stringent than the cleanup level selected at the time EPA issued the OU2 ROD. The change does not affect the protectiveness of the remedy.

OU7
The OU7 ROD identified the National Primary Drinking Water Standards' MCLs for carcinogens and non-zero (MCLGs) for non-carcinogens as ARARs for the groundwater remedial action. This FYR compares the groundwater ARARs identified in Table 7 of the OU7 ROD to current federal standards to determine if any changes have occurred (Table I-1). There are no changes to MCLs or MCLGs since EPA issued the OU7 ROD.

Table I-1: OU7 Groundwater ARAR Comparison

COC[a]	2010 OU7 ROD MCL/MCLG (µg/L)[b]	2017 MCL/MCLG (µg/L)[c]	Change
VOCs			
acetone	--[c]	--	No change
carbon disulfide	--	--	No change
SVOCs			
2-methylphenol (o-cresol)	--	--	No change
4-methylphenol (p-cresol)	--	--	No change
bis(2-ethylhexyl)phthalate	6	6	No change
naphthalene	--	--	No change
pentachlorophenol	1	1	No change
phenol	--	--	No change
Metals			
aluminum	--	--	No change
antimony	6	6	No change
arsenic	10	10	No change
cadmium	5	5	No change
chromium	100	100	No change
cobalt	--	--	No change
cyanide, free	200	200	No change
iron	--	--	No change

COC[a]	2010 OU7 ROD MCL/MCLG (µg/L)[b]	2017 MCL/MCLG (µg/L)[c]	Change
lead	15	15	No change
manganese	--	--	No change
mercury	2	2	No change
nickel	--	--	No change
vanadium	--	--	No change
zinc	--	--	No change

Notes:

a. Groundwater COCs listed in Table 7 of the OU7 ROD.

b. MCLs in effect at the time of OU7 ROD signature, as listed in Table 7 of the OU7 ROD; cleanup goals for those COCs without MCLs/MCLGs were risk-based and are evaluated separately in this FYR.

c. National Primary Drinking Water Regulations available at: https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants (accessed 9/11/17).

d. -- = MCL/MCLG not established

The OU7 ROD also identified TSCA 40 CFR 761.61(c), as an ARAR applicable to the cleanup of PCBs at the Site. EPA determined that the risk-based cleanup approach found in 40 CFR 761.61(c) is relevant and appropriate to the Site. The OU7 ROD selected a risk-based PCB cleanup goal of 25 mg/kg for soil. This FYR evaluates the protectiveness of the PCB cleanup goal in Appendix J.

Appendix A of the OU7 ROD also identifies several ARARs applicable to surface water, air and soil as it relates to protection of groundwater; however, chemical-specific values in effect at the time of ROD issuance were not included in the decision document. Therefore, a detailed evaluation of the criteria is unwarranted.

OU10

The OU10 ROD and OU10 ESD identified several ARARs for surface water, groundwater, air and soil, yet the decision documents presented specific cleanup values only for soil COCs.

The OU10 ROD set a PCB soil cleanup goal of 25 mg/kg total PCBs, based on commercial/industrial land use. This cleanup goal is risk-based and is consistent with the substantive requirements of 40 CFR 761.61(c). This FYR evaluates the protectiveness of the 25 mg/kg PCB cleanup goal in the risk section.

The OU10 ESD set a more stringent PCB soil cleanup goal of 1 mg/kg for the Expanded Plat Area Soils, based on recreational land use. This FYR evaluates the protectiveness of the risk-based 1 mg/kg PCB cleanup goal in the risk section. The cleanup goal is also consistent with EPA's Guidance Remedial Actions for Superfund Sites with PCB Contamination and with the substantive requirements of 40 CFR 761.61 for high occupancy areas.

The OU10 ROD also established soil cleanup standards for direct contact (soils 0 to 10 feet) and groundwater protection (entire depth of soil to the water table). The soil cleanup standards for groundwater protection are based on the non-zero MCLGs. In the absence of a non-zero MCLG, the MCL is used as the groundwater protection standard, when available. To determine compliance, soil samples would be collected and analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) to determine the concentration of a contaminant that could be leached from the soil into pore water. The SPLP concentration would be divided by a dilution attenuation factor of 10. Remediation would be required when the SPLP concentration divided by 10 exceeds the ground water protection soil standard.

This FYR compares the ARARs used as soil cleanup standards for groundwater protection identified in Table 1 of the OU10 ROD to current federal standards (Table I-2). The current MCLG for chloroform is more stringent than the value listed in the OU10 ROD. This change does not call into question the protectiveness of the remedy

because chloroform has not been detected in site groundwater during recent sampling events. All other MCLGs and MCLs have not changed.

Table I-2: OU10 Groundwater ARARs Used to Establish Soil Cleanup Standards for Groundwater Protection

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2017 MCL/MCLG (mg/L)[b]	Change
VOCs			
1,1,2,2-tetrachloroethane	--	--	No change
1,1,1-trichloroethane	0.2	0.2	No change
1,1,2-trichloroethane	0.003	0.003	No change
1,1-dichloroethane	--	--	No change
1,1-dichloroethene	0.007	0.007	No change
1,2-dibromo-3-chloropropane	0.0002	0.0002	No change
1,2-dibromoethane	--	--	No change
1,2-dichloroethane	0.005	0.005	No change
1,2-dichlorobenzene	0.6	0.6	No change
1,2,4-trichlorobenzene	0.07	0.07	No change
1,3-dichlorobenzene	--	--	No change
1,4-dichlorobenzene	0.075	0.075	No change
1,2-dichloropropane	0.005	0.005	No change
2-butanone	--	--	No change
2-hexanone	--	--	No change
4-methyl-2-pentanone (MIBK)	--	--	No change
acetone	--	--	No change
benzene	0.005	0.005	No change
bromochloromethane	--	--	No change
bromodichloromethane	0.08	0.08	No change
bromoform	0.08	0.08	No change
carbon disulfide	--	--	No change
carbon tetrachloride	0.005	0.005	No change
chlorobenzene	0.1	0.1	No change
chloroethane	--	--	No change
chloroform	0.08	0.07 (MCLG)	2017 MCLG more stringent
chloromethane	--	--	No change
cis-1,2-dichloroethene	0.07	0.07	No change
cis-1,3-dichloropropene	--	--	No change
dibromochloromethane	0.06	0.06	No change
ethylbenzene	0.7	0.7	No change
methylene chloride	0.005	0.005	No change
styrene	0.1	0.1	No change
tetrachloroethene	0.005	0.005	No change
toluene	1	1	No change
trans-1,2-dichloroethene	0.1	0.1	No change
trans-1,3-dichloropropene	--	--	No change
trichloroethene	0.005	0.005	No change
vinyl chloride	0.002	0.002	No change
xylenes (total)	10	10	No change
SVOCS			
1,2-diphenylhydrazine	--	--	No change
2,2'oxybis(1-chloropropane)	--	--	No change
2,4,5-trichlorophenol	--	--	No change
2,4,6-trichlorophenol	--	--	No change
2,4-dichlorophenol	--	--	No change

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2017 MCL/MCLG (mg/L)[b]	Change
2,4-dimethylphenol	--	--	No change
2,4-dinitrophenol	--	--	No change
2,4-dinitrotoluene	--	--	No change
2,6-dinitrotoluene	--	--	No change
2-chloronaphthalene	--	--	No change
2-chlorophenol	--	--	No change
2-methylnaphthalene	--	--	No change
2-nitroaniline	--	--	No change
2-nitrophenol	--	--	No change
3,3'-dichlorobenzidine	--	--	No change
3-nitroaniline	--	--	No change
4,6-dinitro-2-methylphenol	--	--	No change
4-bromophenyl phenyl ether	--	--	No change
4-chloroaniline	--	--	No change
4-chlorophenyl phenyl ether	--	--	No change
4-nitroaniline	--	--	No change
4-nitrophenol	--	--	No change
acenaphthene	--	--	No change
acenaphthylene	--	--	No change
anthracene	--	--	No change
benzidine	--	--	No change
benzo(a)anthracene	--	--	No change
benzo(a)pyrene	0.0002	0.0002	No change
benzo(b)fluoranthene	--	--	No change
benzo(g,h,i)perylene	--	--	No change
benzo(k)fluoranthene	--	--	No change
bis(2-chloroethoxy)methane	--	--	No change
bis(2-chloroisopropyl) ether	--	--	No change
bis(2-ethylhexyl)phthalate	0.006	0.006	No change
butyl benzyl phthalate	--	--	No change
carbazole	--	--	No change
p-chloro-m-cresol	--	--	No change
chrysene	--	--	No change
di-n-butylphthalate	--	--	No change
di-n-octyl phthalate	--	--	No change
dibenz(a,h)anthracene	--	--	No change
dibenzofuran	--	--	No change
diethyl phthalate	--	--	No change
dimethyl phthalate	--	--	No change
fluoranthene	--	--	No change
fluorene	--	--	No change
hexachlorobenzene	0.001	0.001	No change
hexachlorobutadiene	--	--	No change
hexachlorocyclopentadiene	0.05	0.05	No change
hexachloroethane	--	--	No change
indeno(1,2,3-cd)pyrene	--	--	No change
isophorone	--	--	No change
n-nitrosodiphenylamine	--	--	No change
n-nitrosodipropylamine	--	--	No change
naphthalene	--	--	No change
nitrobenzene	--	--	No change
p-chloro-m-cresol	--	--	No change
p-(dimethylamino)azobenzene	--	--	No change
pentachlorobenzene	--	--	No change

COC[a]	2004 OU10 ROD MCL/MCLG (mg/L)[a]	2017 MCL/MCLG (mg/L)[b]	Change
pentachlorophenol	0.001	0.001	No change
phenanthrene	--	--	No change
o-cresol/2-methylphenol	--	--	No change
p-cresol/4-methylphenol	--	--	No change
phenol	--	--	No change
pyrene	--	--	No change
Metals			
aluminum	--	--	No change
antimony	0.006	0.006	No change
arsenic	0.01	0.01	No change
barium	2	2	No change
beryllium	0.004	0.004	No change
cadmium	0.005	0.005	No change
calcium	--	--	No change
chromium	0.1	0.1	No change
cobalt	--	--	No change
copper	1.3	1.3	No change
iron	--	--	No change
lead	0.015	0.015	No change
magnesium	--	--	No change
manganese	--	--	No change
mercury	0.002	0.002	No change
nickel	--	--	No change
potassium	--	--	No change
selenium	0.05	0.05	No change
silver	--	--	No change
sodium	--	--	No change
thallium	0.0005	0.0005	No change
vanadium	--	--	No change
zinc	--	--	No change
cyanide, Free	0.2	0.2	No change
PCBs			
Arochlor 1016	0.0005	0.0005	No change
Arochlor 1221	0.0005	0.0005	No change
Arochlor 1232	0.0005	0.0005	No change
Arochlor 1242	0.0005	0.0005	No change
Arochlor 1248	0.0005	0.0005	No change
Arochlor 1254	0.0005	0.0005	No change
Arochlor 1260	0.0005	0.0005	No change

Notes:

a. Soil COCs listed in Table 1 of the OU10 ROD.

b. MCLs/MCLGs in effect at the time of OU10 ROD signature, as listed in Table 1 of the OU10 ROD; groundwater protection cleanup goals for those COCs without MCLs/MCLGs were risk-based and are evaluated separately in this FYR.

c. National Primary Drinking Water Regulations available at: https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants (accessed 9/12/17).

-- = MCL/MCLG not established
mg/L = milligrams per liter

APPENDIX J – DETAILED TOXICITY REVIEW AND VAPOR INTRUSION SCREENING

Toxicity Review

OU2

The OU2 ROD selected a total PCBs soil cleanup goal of 10 mg/kg based on an anticipated industrial land use. Table J-1 evaluates the current validity of the cleanup goal using 2017 EPA RSLs; the RSLs incorporate current toxicity values and standard default exposure factors.

The evaluation demonstrates that the OU2 total PCBs cleanup goal of 10 mg/kg remains valid for commercial/industrial use as the concentration is within EPA's risk management range of 1×10^{-6} to 1×10^{-4}.

Table J-1: Review of OU2 Soil Remedial Goal – Total PCBs

COC	Soil Remedial Goal (mg/kg)	Composite Worker RSL[a]		Risk[b]	HQ[c]
		10^{-6} Risk	Hazard Quotient (HQ) = 1.0		
PCBs, total	10	9.4E-01[d]	NA	1.06E-05	NA

Notes:

a) EPA's soil RSLs, dated June 2017, available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017, accessed 09/18/17.

b) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1×10^{-6} risk: Cancer risk = (cleanup goal ÷ cancer-based RSL) × 10^{-6}.

c) Noncancer HQ calculated using the following equation: HQ = (cleanup goal ÷ noncancer RSL).

d) RSL for PCBs (high risk) used.

NA = EPA has not finalized a noncarcinogenic toxicity value for this group of compounds

OU7

The OU7 ROD selected MCLs and non-zero MCLGs as preliminary remedial goals for groundwater. In the absence of MCLs and non-zero MCLGs, risk-based concentrations were selected as the preliminary remedial goals. To determine if the risk-based preliminary remedial goals for groundwater remain protective, the preliminary remedial goals were compared to EPA's 2017 tapwater RSLs (Table J-2).

Based on the evaluation, preliminary remedial goals for carcinogenic COCs fall within EPA's acceptable risk management range of 1×10^{-6} to 1×10^{-4}. Preliminary remedial goals for 12 COCs result in HQs that exceed EPA's benchmark of 1 for noncarcinogens. Although the preliminary remedial goals exceed the noncarcinogenic benchmark, the OU7 ROD states that remediation of groundwater at the Site will continue until the respective MCLs for the COCs are attained and the excessive cancer risk associated with potential residential use of the groundwater is reduced to one in 10,000 (1×10^{-4}) and the hazard index is reduced to 1 for each specific organ. As cleanup progresses, EPA may wish to revisit the preliminary remediation goals to better align with the final groundwater cleanup goal. In the interim, there are no complete exposure pathways between contaminated groundwater and receptors.

Table J-2: Review of OU7 Groundwater Remedial Goals

COC	Risk-based Remedial Goal[a] (µg/L)	Tapwater RSL[b]		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
acetone	22,000	--[f]	1.40E+04	--	**1.57E+00**
carbon disulfide	1,000	--	8.10E+02	--	**1.23E+00**
2-methylphenol	1,800	--	9.3E+02	--	**1.94E+00**
4-methylphenol	180	--	1.9E+03	--	9.47E-02
bis(2-ethylhexyl)phthalate	NA[e]	NA	NA	NA	NA
naphthalene	14	1.7E-01	6.1E+00	8.23E-05	**2.30E+00**
pentachlorophenol	NA	NA	NA	NA	NA
phenol	11,000	--	5.8E+03	--	**1.90E+00**
aluminum	37,000	--	2.0E+04	--	**1.85E+00**
antimony	NA	--	--	--	--
arsenic	NA	--	--	--	--
cadmium	NA	--	--	--	--
chromium	NA	--	--	--	--
cobalt	11	--	6.0E+00	--	**1.83E+00**
cyanide, free	NA	NA	NA	NA	NA
iron	26,000	--	1.4E+04	--	**1.86E+00**
lead	NA	NA	NA	NA	NA
manganese	880	--	4.30E+02	--	**2.05E+00**
mercury	NA	NA	NA	NA	NA
nickel	730	--	3.90E+02	--	**1.87E+00**
vanadium	260	--	8.6E+01	--	**3.02E+00**
zinc	11,000	--	6.0E+03	--	**1.83E+00**

Notes:

a) Risk-based remedial goal listed in Table 7 of the OU7 ROD; presented at cancer/hazard target benchmarks of 1 x 10^{-4} for carcinogens and 1 for noncarcinogens.

b) EPA's tapwater RSLs, dated June 2017, available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017, accessed 09/18/17.

c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: cancer risk = (remedial goal ÷ cancer-based RSL) × 10^{-6}.

d) Noncancer HQ calculated using the following equation: HQ = (remedial goal ÷ noncancer RSL).

NA = not applicable; remedial goal for this COC is the MCL or non-zero MCLG and is not a risk-based concentration

-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound

Bold = HQ exceeds 1

The OU7 ROD also identified soil remedial goals for soil located outside the VB 9, 10 and 11 cover systems. All non-hazardous soil and sediment that did not exceed the groundwater protection standards but that exceeded the RSLs for industrial soil at a total excess cancer risk and/or EPA's Region 3 Ecologically Protective Backfill Values, as listed in Table 11 in the OU7 ROD and modified by the 2012 ESD, were to be excavated and placed into the basins under the cap. The OU7 ROD did not identify specific RSLs in effect at that time. However, Table 2 of the 2015 Remedial Action Report for the Viscose Basins 9-11 Cap System and Groundwater & Leachate Extraction Components of Operable Unit 7 listed the Revised Soil Cleanup Standards - Direct Contact and Ground Water Protection. This FYR compares the lower of the human health direct contact standards included in Table 2 of the OU7 Remedial Action Report to EPA's 2017 composite worker soil RSLs to determine if the standards remain protective for human health (Table J-3).

Based on the evaluation, soil standards based on direct contact for carcinogenic COCs fall within or below EPA's acceptable risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The soil standard for mercury results in an HQ that slightly exceeds EPA's benchmark of 1 for noncarcinogens. However, it should be noted that EPA's default composite worker RSLs are based on a conservative ingestion rate of 100 mg/kg/day; the OU7 human health direct contact standards were calculated using a site-specific ingestion rate of 50 mg/kg/day. This finding does not affect the protectiveness of the remedy because all soils with concentrations above the standards listed in Table 2 of the 2015 Remedial Action Report were excavated and the areas were either covered with the VB 9-11 cap system, including the geomembrane barrier, or were covered with 2 feet of soil to mitigate the ecological pathway. There are no complete exposure pathways for human or ecological receptors.

Table J-3: Review of OU7 Soil Remedial Goals – Human Health Direct Contact

COC	HH Direct Contact Standard[a] ($1x10^{-6}$ Risk and/or HQ=1) (mg/kg)	Composite Worker RSL[b]		Risk[c]	HQ[d]
		10^{-6} Risk	HQ=1		
carbon disulfide	378	--	3,500	--	0.1
ethylbenzene	NV	NA	NA	NA	NA
styrene	NV	NA	NA	NA	NA
toluene	NV	NA	NA	NA	NA
xylenes (total)	NV	NA	NA	NA	NA
acenaphthene	NV	NA	NA	NA	NA
anthracene	NV	NA	NA	NA	NA
benzo(a)anthracene	7.8	21	--	3.7E-07	--
benzo(a)pyrene	0.78	2.1	--	3.7E-07	--
benzo(b)fluoranthene	7.8	21	--	3.7E-07	--
benzo(k)fluoranhene	78.4	210	--	3.7E-07	--
dibenz(a,h)anthracene	0.78	2.1	--	3.7E-07	--
fluoranthene	NV	NA	NA	NA	NA
fluorene	NV	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	7.8	21	--	3.7E-07	--
naphthalene	18	17	--	1.1E-06	--
phenanthrene	NV	NA	NA	NA	NA
pyrene	NV	NA	NA	NA	NA
PAHs, high molecular weight	NV	NA	NA	NA	NA
PAHs, low molecular weight	NV	NA	NA	NA	NA
PAHs, total	NV	NA	NA	NA	NA
aluminum	NV	NA	NA	NA	NA
antimony	81.8	--	470	--	1.74E-01
arsenic	3.8	3	480	1.3E-06	7.92E-03
barium	NV	NA	NA	NA	NA
cadmium	NV	NA	NA	NA	NA
chromium	NV	NA	NA	NA	NA
cobalt	60	1900	350	3.2E-08	1.71E-01
copper	8,180	--	47,000	--	1.74E-01
iron	143,000	--	820,000	--	1.74E-01
lead[e]	800	--	--	NA	NA
manganese	NV	NA	NA	NA	NA
mercury	61	--	46	--	**1.33E+00**

nickel	NV	NA	NA	NA	NA
selenium	1,020	--	5,800	--	1.76E-01
silver	NV	NA	NA	NA	NA
vanadium	1,030	--	5,800	--	1.78E-01
zinc	61,300	--	350,000	--	1.75E-01

Notes:

a) Direct contact cleanup standard listed in Table 2 of the OU7 Remedial Action Report; the lower of the direct contact standards is presented.

b) EPA's composite worker RSLs, dated June 2017, available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017, accessed 09/18/17.

c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: cancer risk = (remedial goal ÷ cancer-based RSL) × 10^{-6}.

d) Noncancer HQ calculated using the following equation: HQ = (remedial goal ÷ noncancer RSL).

e) The OU7 cleanup standard for lead is consistent with the current industrial RSL for lead of 800 mg/kg.

NV = no value available; cleanup standard for this COC is the ecologically protective soil value
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound
Bold = HQ exceeds 1

OU10

The OU10 ROD set soil cleanup goals for PCBs and additional COCs, based on commercial/industrial land use and protection of groundwater. The OU10 ROD states that soil cleanup standards for OU10 shall not exceed a cumulative excess cancer risk of 1 x 10^{-4} and the cumulative effect for non-carcinogens on any target organ shall not exceed a HQ of 1. A risk analysis of all the Plant Area Soils remaining on-site after the completion of the remedial action (based on over 500 post-excavation samples) was conducted in 2012 and demonstrated that the soils from zero to 10 feet bgs are protective of human health for an industrial/ commercial scenario and both the surface and the deeper soils are protective of groundwater. A 2014 SLERA on post remediation soils identified multiple chemicals of potential ecological concern. However, the assessment concluded that the magnitude and duration of ecological exposures are not expected to produce significant ecological risk due to the presence of relatively low-quality habitat that offers only limited foraging, cover or nesting opportunities. As future land use at the Plant Area Soils part of the Site is expected to be developed for commercial/industrial uses, the SLERA also concluded that such development will eliminate ecological habitat.

EPA submitted review comments on the SLERA to FMC in August 2015. EPA commented that several aspects of the assessment need to be further and more thoroughly addressed. EPA concluded that while future use of the area is intended to be industrial/commercial, the potential for unacceptable ecological risk currently exists and will continue to exist into the future until exposure pathways are eliminated. The ecological risk assessment of the Plant Area Soils part of the Site had previously been delayed due to the promise of redevelopment. However, the area remains vacant and it is unclear when development will occur. EPA also noted that, even with development, it is unknown if such development would effectively mitigate the potential for unacceptable risks to ecological receptors.

The OU10 ESD also set soil cleanup goals based on residential land use for the Expanded Plant Area Soils (Figure J-1). Table J-4 evaluates the current validity of the cleanup goals using EPA RSLs for residential soil. The lowest of the human health direct contact standards included in Table 1A of the OU10 ESD was used for the evaluation. The evaluation demonstrates that the direct contact cleanup goals remain valid for most COCs. Carcinogenic risks associated with the soil remedial goals for 1,1-dichloroethane, chloroform, ethylbenzene and chromium exceed the upper end of EPA's risk management range of 1 x 10^{-6} to 1 x 10^{-4}. The HQs associated with the soil remedial goals for 1,1-dichloroethene, 1,2,4-trichlorobenzene, 2-hexanone, carbon disulfide, total xylenes, hexachlorocyclopentadiene, naphthalene, chromium, cobalt, manganese and free cyanide exceed EPA's benchmark of 1 for noncarcinogens. In April 2006 FMC excavated contaminated Expanded Plant Area Soils from the Burnt Debris Area that contained COCs at concentrations above the established residential soil cleanup goals and disposed of it either off site or on-site, depending on the level of soil contamination. This FYR included review of the post-excavation soil characterization samples for Burnt Debris Area and comparison to current

residential RSLs (Table J-5). Based on pre-excavation sampling results that showed most constituents were not detected or below screening criteria, post-excavation soil characterization samples were analyzed for lead, manganese and mercury only. Review of the post-excavation data determined that the soils remaining in the area do not pose an unacceptable risk to human health based on a residential exposure scenario.

Table J-4: Review of OU10 Residential Soil Cleanup Goals for the Expanded Plant Area Soils

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
1,1,2,2-tetrachloroethane	3.2	0.6	1,600	5.3E-06	2.0E-03
1,1,1-trichloroethane	2,200	--	8,100	--	2.7E-01
1,1,2-trichloroethane	1.1	1.1	1.5	1.0E-06	7.3E-01
1,1-dichloroethane	1,600	3.6	16,000	**4.4E-04**	1.0E-01
1,1-dichloroethene	390	--	230	--	**1.7E+00**
1,2-dibromo-3-chloropropane	0.46	0.0053	4.7	8.7E-05	9.8E-02
1,2-dibromoethane	0.32	0.036	73	8.9E-06	4.4E-03
1,2-dichloroethane	7	0.46	31	1.5E-05	2.3E-01
1,2-dichlorobenzene	700	--	1,800	--	3.9E-01
1,2,4-trichlorobenzene	78	24	58	3.3E-06	**1.3E+00**
1,3-dichlorobenzene	23	--	--	--	--
1,4-dichlorobenzene	27	2.6	3,400	1.0E-05	7.9E-03
1,2-dichloropropane	9.4	0.28	16	3.4E-05	5.9E-01
2-butanone	4,700	--	27,000	--	1.7E-01
2-hexanone	313	--	200	--	**1.6E+00**
4-methyl-2-pentanone (MIBK)	NV	NA	33,000	NA	NA
acetone	7,000	--	61,000	--	1.1E-01
benzene	12	1.2	82	1.0E-05	1.5E-01
bromochloromethane	NV	NA	NA	NA	NA
bromodichloromethane	10	0.29	1,600	3.4E-05	6.3E-03
bromoform	81	19	1,600	4.3E-06	5.1E-02
carbon disulfide	780	--	770	--	**1.0E+00**
carbon tetrachloride	4.9	0.65	100	7.5E-06	4.9E-02
chlorobenzene	160	--	280	--	5.7E-01
chloroethane	220	--	14,000	--	1.6E-02
chloroform	78	0.32	200	**2.4E-04**	3.9E-01
chloromethane	NV	NA	NA	NA	NA
cis-1,2-dichloroethene	78.2	--	160	NA	4.9E-01
cis-1,3-dichloropropene	6.4	1.8	72	3.6E-06	8.9E-02
dibromochloromethane	7.6	8.3	1,600	9.2E-07	4.8E-03
ethylbenzene	780	5.8	3,400	**1.3E-04**	2.3E-01
methylene chloride	85	57	350	1.5E-06	2.4E-01
styrene	1,600	--	6,000	--	2.7E-01
tetrachloroethene	1.2	24	81	5.0E-08	1.5E-02
toluene	630	--	4,900	--	1.3E-01
trans-1,2-dichloroethene	160	--	1,600	--	1.0E-01
trans-1,3-dichloropropene	6.4	1.8	72	3.6E-06	8.9E-02
trichloroethene	1.6	0.94	4.1	1.7E-06	3.9E-01

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
vinyl chloride	0.09	0.059	70	1.5E-06	1.3E-03
xylenes (total)	1,600	--	580	--	**2.8E+00**
1,2-diphenylhydrazine	0.8	0.68	NA	1.2E-06	NA
2,2'oxybis(1-chloropropane)	NV	NA	NA	NA	NA
2,4,5-trichlorophenol	780	--	6,300	--	1.2E-01
2,4,6-trichlorophenol	58	49	63	1.2E-06	9.2E-01
2,4-dichlorophenol	23	--	190	--	1.2E-01
2,4-dimethylphenol	160	--	1,300	--	1.2E-01
2,4-dinitrophenol	16	--	130	--	1.2E-01
2,4-dinitrotoluene	16	1.7	130	9.4E-06	1.2E-01
2,6-dinitrotoluene	7.8	0.36	19	2.2E-05	4.1E-01
2-chloronaphthalene	630	--	4,800	--	1.3E-01
2-chlorophenol	39	--	390	--	1.0E-01
2-methylnaphthalene	31	--	240	--	1.3E-01
2-nitroaniline	NV	--	630	--	--
2-nitrophenol	NV	NA	NA	NA	NA
3,3'-dichlorobenzidine	1.4	1.2	--	1.2E-06	--
3-nitroaniline	2.3	--	--	--	--
4,6-dinitro-2-methylphenol	0.78	--	5.1	--	1.5E-01
4-bromophenyl phenyl ether	NV	NA	NA	NA	NA
4-chloroaniline	31	2.7	250	1.1E-05	1.2E-01
4-chlorophenyl phenyl ether	NV	NA	NA	NA	NA
4-nitroaniline	23.5	27	250	8.7E-07	9.4E-02
4-nitrophenol	62.6	--	--	--	--
acenaphthene	470	--	3600	--	1.3E-01
acenaphthylene	NV	NA	NA	NA	NA
anthracene	2,300	--	18,000	--	1.3E-01
benzidine	0.0028	0.00053	190	5.3E-06	1.5E-05
benzo(a)anthracene	0.87	1.1	--	7.9E-07	--
benzo(a)pyrene	0.087	0.11	18	7.9E-07	4.8E-03
benzo(b)fluoranthene	0.87	1.1	--	7.9E-07	--
benzo(g,h,i)perylene	NV	NA	NA	NA	NA
benzo(k)fluoranhene	8.7	11	--	7.9E-07	--
bis(2-chloroethoxy)methane	0.58	--	190	--	3.1E-03
bis(2-chloroisopropyl) ether	9.1	--	--	--	--
bis(2-ethylhexyl)phthalate	46	39	1,300	1.2E-06	3.5E-02
butyl benzyl phthalate	340	290	13,000	1.2E-06	2.6E-02
carbazole	32	--	--	--	--
p-chloro-m-cresol	NV	NA	NA	NA	NA
chrysene	87	110	--	7.9E-07	--
di-n-butyl phthalate	780	--	6,300	--	1.2E-01
di-n-octyl phthalate	313	--	630	--	5.0E-01
dibenz(a,h)anthracene	0.087	0.11	--	7.9E-07	--
dibenzofuran	15.6	--	73	--	2.1E-01

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
diethyl phthalate	6,300	--	51,000	--	1.2E-01
dimethyl phthalate	78,200	--	--	--	--
fluoranthene	310	--	2,400	--	1.3E-01
fluorene	310	--	2,400	--	1.3E-01
hexachlorobenzene	0.4	0.21	63	1.9E-06	6.4E-03
hexachlorobutadiene	1.56	1.2	78	1.3E-06	2.0E-02
hexachlorocyclopentadiene	47	--	1.8	--	**2.6E+01**
hexachloroethane	7.8	1.8	45	4.3E-06	1.7E-01
indeno(1,2,3-cd)pyrene	0.87	1.1	--	7.9E-07	--
isophorone	670	570	13,000	1.2E-06	5.2E-02
n-nitrosodiphenylamine	130	110	--	1.2E-06	--
n-nitrosodipropylamine	0.091	0.078	--	1.2E-06	--
naphthalene	160	3.8	130	4.2E-05	**1.2E+00**
nitrobenzene	3.9	5.1	130	7.6E-07	3.0E-02
p-chloro-m-cresol	NV	NA	NA	NA	NA
p-(dimethylamino)azobenzene	NV	NA	NA	NA	NA
pentachlorobenzene	6.3	--	63	--	1.0E-01
pentachlorophenol	2.5	1	250	2.5E-06	1.0E-02
phenanthrene	NV	NA	NA	NA	NA
o-cresol/2-methylphenol	390	--	3,200	--	1.2E-01
p-cresol/4-methylphenol	39	--	6,300	--	6.2E-03
phenol	2,300	--	19,000	--	1.2E-01
pyrene	230	--	1,800	--	1.3E-01
aluminum	7,820	--	77,000	--	1.0E-01
antimony	3.1	--	31	--	1.0E-01
arsenic	15.9	0.68	35	2.3E-05	4.5E-01
barium	1,600	--	15,000	--	1.1E-01
beryllium	16	1,600	160	1.0E-08	1.0E-01
cadmium	7.8	2,100	71	3.7E-09	1.1E-01
calcium	NV	NA	NA	NA	NA
chromium	233	0.3[e]	230[e]	**7.8E-04**	**1.0E+00**
cobalt	156	420	23	3.7E-07	**6.8E+00**
copper	310	--	3,100	--	1.0E-01
iron	2,300	--	55,000	--	4.2E-02
lead	400	--	NA	--	NA
magnesium	NV	NA	NA	NA	NA
manganese	2,272	NA	1,800	--	**1.3E+00**
mercury	0.78	NA	11	--	7.1E-02
nickel	160	15,000	1,500	1.1E-08	1.1E-01
potassium	NV	NA	NA	NA	NA
selenium	39	--	390	--	1.0E-01
silver	39	--	390	--	1.0E-01
sodium	NV	NA	NA	NA	NA
thallium	0.55	--	0.78	--	7.1E-01
vanadium	184	--	390	--	4.7E-01

COC	Soil Remedial Goal, Direct Contact[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
zinc	2,300	--	23,000	--	1.0E-01
cyanide, free	1,600	--	23	--	**7.0E+01**
PCBs, total	1	0.23	--	4.3E-06	--
Arochlor 1016	5.5	6.7	4.1	--	--
Arochlor 1221	0.32	0.2	--	1.6E-06	--
Arochlor 1232	0.32	0.17	--	1.9E-06	--
Arochlor 1242	0.32	0.23	--	1.4E-06	--
Arochlor 1248	0.32	0.23	--	1.4E-06	--
Arochlor 1254	0.32	0.24	--	1.3E-06	--
Arochlor 1260	0.32	0.24	--	1.3E-06	--

Notes:

a) Soil remedial goal is the lowest of the human health direct contact standards presented in Table 1A of the OU10 ESD.
b) EPA's residential soil RSLs, dated June 2017, available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017, accessed 09/18/17.
c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: Cancer risk = (cleanup goal ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (cleanup goal ÷ noncancer RSL).
e) RSL for hexavalent chromium.

NV = no value available
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound
Bold = risk exceeds EPA's risk management range of 10^{-6} to 10^{-4} or HQ exceeds 1

Table J-5: Screening-level Evaluation of Post-Remediation Soil – Burnt Debris Area of Expanded Plant Area Soils

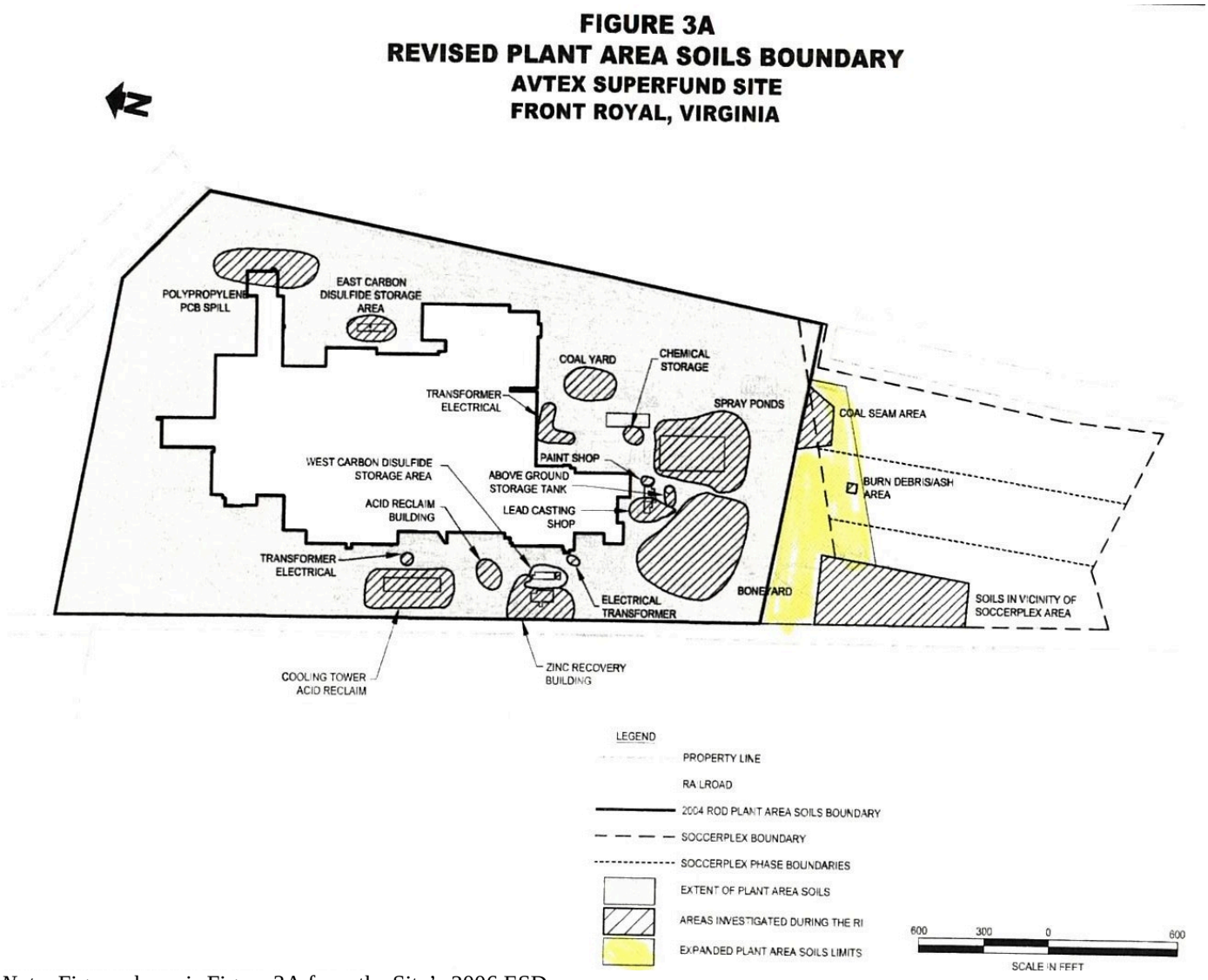
COC	Maximum Detected Concentration Remaining in Soil[a] (mg/kg)	Residential RSL[b] (mg/kg)		Risk[c]	HQ[d]
		10^{-6} Risk	HQ = 1.0		
lead[e]	11	--	NA	--	NA
manganese	1,730 J	NA	1,800	--	9.6E-01
mercury	0.0453J	NA	11	--	4.0E-03

Notes:

a) Maximum detected concentration from Table 1 of the Burnt Debris Area Post-Excavation Sample Results for the SoccerPlex Parcel, dated July 26, 2006
b) EPA's residential soil RSLs, dated June 2017, available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017, accessed 09/18/17.
c) Cancer risk calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk: Cancer risk = (maximum detected concentration ÷ cancer-based RSL) × 10^{-6}.
d) Noncancer HQ calculated using the following equation: HQ = (maximum detected concentration ÷ noncancer RSL).
e) The maximum detected lead concentration is below the residential soil RSL of 400 mg/kg.

J = estimated value
NA = not applicable
-- = EPA has not finalized a carcinogenic or noncarcinogenic toxicity value for this compound

Figure J-1. Expanded Plant Area Soils Area – OU10



Note: Figure above is Figure 3A from the Site's 2006 ESD.

Vapor Intrusion Screening

The vapor intrusion pathway was not evaluated in the OU7 human health risk assessment. Groundwater contamination currently extends from beneath the former viscose basins to the west side of the Shenandoah River near residential properties. Because volatile contaminants have been detected in groundwater, this FYR includes a screening level vapor intrusion evaluation using EPA's VISL calculator to determine the potential for vapor intrusion to indoor air at both the former facility property and at the downgradient residential properties.

The only structure on the basin side of the Site is the GLTP. This structure was built on top of a vapor barrier. Therefore, the vapor intrusion pathway is currently incomplete and no further evaluation is necessary for current receptors. To determine if vapor instruction may be a concern if buildings are constructed in the future, the 2015 maximum detected concentrations of volatile COCs from overburden monitoring well MW-09 were assessed using the VISL calculator. Because institutional controls are in place that prohibit future residential use of the property, a default commercial exposure scenario was evaluated.

As shown in Table J-6, the 2015 concentrations of acetone and carbon disulfide (both noncarcinogens) result in HQs well below EPA's target HQ of 1 under a commercial use scenario, which suggests that vapor intrusion would not be a concern. However, if concentrations increase or anticipated land use changes, the potential for vapor intrusion within the basin property should be re-evaluated.

Although groundwater contamination extends to the west side of the river near residential properties, the potential for vapor intrusion is low. There are no overburden wells currently installed on the west side of the river. However, based on the direction of overburden groundwater flow in this area (east and southeast, toward the river) and the limited extent of VOC contamination in the overburden on the east side of the river, impacts in the overburden on the west side of the river are unlikely. Two shallow bedrock wells installed near the residential properties (162 and 185) on the west side of the river did not detect VOCs or SVOCs above method detection limits during the 2015 sampling event. VOCs and SVOCs were detected in the deeper intermediate and deep bedrock zones in the vicinity of the residential properties; however, these zones are overlain by uncontaminated groundwater. The depth of the contamination in the intermediate and deep bedrock zones is also greater than 200 feet bgs and unlikely to be a concern for vapor intrusion, as it is greater than the 100-foot buffer recommended for vapor intrusion evaluations. These results support that contaminant vapors are not reaching groundwater near the residential properties at this time. If concentrations in the shallow bedrock zone increase, the potential for vapor intrusion should be re-evaluated in the future.

Table J-6: VISL Calculator Screening – Basin Side

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.45, November 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

	CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m³)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m³)⁻¹	IUR Source*	Reference Concentration RfC (mg/m³)	RFC Source*	Mutagenic Indicator i
x	67-64-1	Acetone	2.8E+03	4.01E+00	No IUR	3.0E-05			3.10E+01	A	
x	75-15-0	Carbon Disulfide	7.5E+02	4.42E+00	No IUR	1.4E-01			7.00E-01	I	

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	25
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	25
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	250
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**
Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	0.00E+00
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 25 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

APPENDIX K – INTERVIEW FORM

Avtex Fibers Superfund Site **Five-Year Review Interview Form**

Site Name: Avtex Fibers **EPA ID No.:** VAD070358684

Interviewer Name: Jeffrey Thomas **Affiliation:** EPA
Subject Name: Jennifer McDonald **Affiliation:** EDA Executive Director
Subject Contact Information: PO Box 445, Front Royal, Virginia 22630-2910
Time: 1450 hours **Date:** 02/14/2018
Interview Location: Via Phone

Interview Format (circle one): In Person X Phone Mail Other:

Interview Category: Site Owner Representative

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date? **Yes.**

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)? **The cleanup took longer than expected. However, the end result was a property that is ready for redevelopment. FMC has been very gracious to the community of Front Royal during the cleanup.**

3. What have been the effects of this Site on the surrounding community, if any? **In the past five years there have not been any effects of the Site to the surrounding community.**

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing? **None known by the interviewee.**

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future? **In the past five years there has not been a need to inform involved parties and surrounding neighbors of activities at the Site.**

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used? **No private wells are present on the property and the EDA building utilizes municipal water and sewer.**

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project? **The timing of partial release of deeds of trust takes more time that was expected. The EDA requests that future release be completed in a manner to facilitate prompt real estate transactions. The first parcel has broken ground and there appears to be increased interest on other parcels for future development.**

Avtex Fibers Superfund Site **Five-Year Review Interview Form**

Site Name: Avtex Fibers **EPA ID No.:** VAD070358684

Interviewer Name: Jeff Thomas **Affiliation:** EPA
Subject Name: Michelle Payne **Affiliation:** VADEQ
Subject Contact Information: Michelle.Hollis@deq.virginia.gov
Time: 10:00 am **Date:** 02/23/2018
Interview Location: Via Telephone

Interview Format (circle one): In Person **X Phone** Mail Other:

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?
   The site has an excellent PRP that produces and submits site reports in a timely manner. The EDA is responsible for the redevelopment of the site and appears to be progressing with that task.

2. What is your assessment of the current performance of the remedy in place at the Site?
   The remedy appears to be working as designed.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?
   No.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.
   The State has participated in the FYR process including the inspection and reviewed site documents and reports.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?
   No.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?
   The State would like to finalize ICs to prevent wells from being installed on the privately-owned properties on the west side of the river that overlie the plume.
7. Are you aware of any changes in projected land use(s) at the Site?
   No.

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   No.

APPENDIX L – PRESS NOTICE

EPA REVIEWS CLEANUP

Avtex Fibers Superfund Site

The U.S. Environmental Agency is reviewing the cleanup that was conducted at the Avtex Fibers, Inc. Superfund Site located in Front Royal. EPA inspects sites regularly to ensure that cleanups conducted remain protective of public health and the environment. EPA's previous review of the site in 2013 determined that the cleanup remedies in place were working as designed. Findings from the current review being conducted will be available March 2018.

To access the review, or to provide site-related information:
Contact: Larry Johnson, *Community Involvement Coordinator*
Phone: 215-814-3239
Email: johnson.larry-c@epa.gov

To access detailed site information, including Review Report:
https://www.epa.gov/superfund/avtex

Protecting human health and the environment